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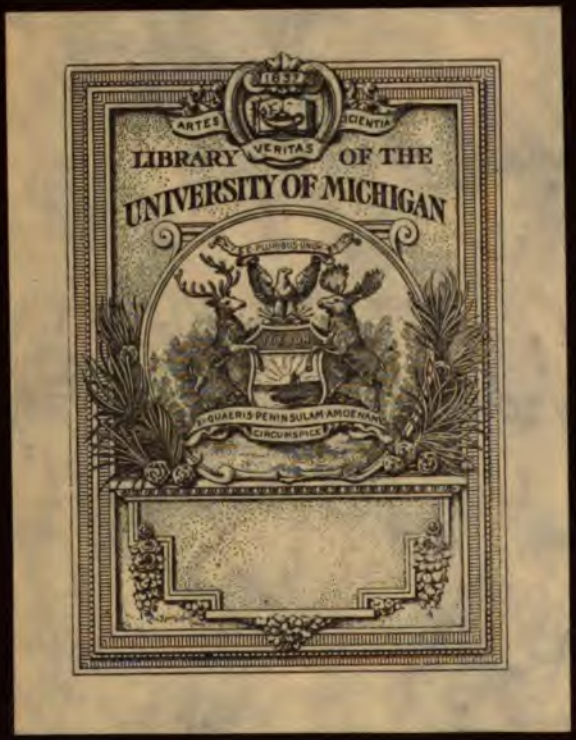
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OF GREAT BRITAIN AND IRELAND.

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,, Journals Sales—							Printing Volume III.			£219	11	0
Institutes	£118	13	5				,, Examinations—					
Layton & Company.	14	9	8				Printing and Stationery	£23	7	0		
Sundry Sales	7	10	3				Educational Scheme—J. G. Boss ...	5	17	2		
				140	13	4					29	4	2
,, Examinations—							,, General Expenses—					
Entrance Fees				28	7	6	Secretary's Salary	£35	0	0		
,, Contributions—							Allowance for Office Expenses	15	0	0		
From Insurance Companies	£84	7	0				Postages and Petty Cash	30	17	0		
,, Institutes	36	15	6				Printing and Stationery	7	11	6		
				121	2	6	Postages, Orphanage	5	0	0		
											93	8	6
,, Bank Interest				1	16	7	,, Balance in Bank				102	12	11
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FEDERATION OF INSURANCE INSTITUTES

OF

GREAT BRITAIN AND IRELAND.

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Founded 1887.

Objects: (1st) The reading of papers and delivering of lectures by members, or experts who are not members, upon subjects connected with Insurance business generally. (2nd) The discussion of all questions relating to such business. (3rd) The promotion of social intercourse amongst members of the profession in Birmingham and district.

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ENTERTAINMENT COMMITTEE—A. P. Earl, W. E. Fudger, C. H. Fuller, R. Junkin, W. C. Macdonald, F. J. Sparling, C. W. I. Woodland.

THE FEDERATION OF INSURANCE INSTITUTES OF GREAT BRITAIN AND IRELAND.

THE Sixth Annual Conference was held at the Shelbourne Hotel, Dublin, on Friday, June 13, 1902, on the invitation of the Insurance Institute of Ireland. Mr. Bernard H. O'Reilly (*Patriotic*), the President of the Federation, occupied the chair, and there were present:—

EX-PRESIDENT: David L. Laidlaw (*North British and Mercantile*), Glasgow.

PAST PRESIDENTS: J. B. Tennant, F.I.A. (*Friends' Provident*), Bradford, 1899; S. G. Moxey (*Prudential*), Bristol, 1900.

HON. TREASURER: Thomas A. Bentley (*London and Lancashire*), Manchester.

HON. SECRETARY to the Insurance Institute of Ireland: H. Dudley-Fletcher (*Patriotic*).

SECRETARY: Charles Stevenson, Manchester; and the following delegates:—

BRISTOL: S. G. Moxey (*Prudential*), A. D. Brookes (*Alliance*).

GLASGOW: Henry G. Andrewes (*Scottish Union and National*), President; Stewart Lawrie (*Alliance*), Hon. Secretary.

IRELAND: E. Tenison Collins (*North British and Mercantile*), C. Chevalier Cream (*National of Ireland*), C. R. Dunbar (*Liverpool and London and Globe*).

MANCHESTER (Institute): G. L. Lambert (*North British and Mercantile*), R. M'Connell (*Royal*), C. Hobbins (*Rock*).

MANCHESTER (Association): G. Douglas Wicks (*General*), James Fallow (*Liverpool and London and Globe*), Hon. Secretary.

NEWCASTLE-ON-TYNE: J. H. Chapman (*Norwich Union*), Hon. Secretary.

NOTTINGHAM: G. D. Potts (*Hand-in-Hand*), Vice-President.

YORKSHIRE: C. M. Tate (*Ocean*), Past President; J. W. Wootton (*Sun Life*), W. Holbrook (*Royal*).

THE

FEDERATION OF INSURANCE INSTITUTES

OF

GREAT BRITAIN AND IRELAND.

After the adoption of the Minutes of last Conference, the Secretary read the Report of Executive Committee, 1902.

The fifth year of the Federation has been marked by steady development.

The Insurance Clerks' Orphanage Scheme initiated under its fostering wing has now taken definite form, and, under influential auspices and guided by a large representative Committee of the leading Insurance men, is now about to be started as an independent Institution with every prospect of a useful and beneficent career.

The fourth volume of the Journal was issued early in January, and its contents maintain the high character of the preceding volumes. The demand for this publication, both at home, in India, and in the Colonies, necessitated the printing of a larger number this year, and again testifies to the value it is regarded by a large circle of readers and students. Two thousand copies of this volume were printed and issued early in January, and all but 802 have been disposed of. The 17 papers contained in the volume comprise 10 Fire papers, three Life papers, and one each on Marine Insurance, Workmen's Compensation, and on Daily Questions of Legal Title, besides one general paper on the Aims and Rewards of an Insurance Career.

One of the aims of the Federation being to encourage the younger members of the profession in their study of the business, and thus qualify them eventually for the more

responsible positions, the Conference last year adopted a more complete scheme of examination, in the hope that Insurance clerks generally would be stimulated in their studies by the prospect of the certificate of the Federation.

The results, as a whole, are distinctly satisfactory. The percentage of failures is less than the average of previous examinations, although the standard of the papers has been fully maintained, while the average age of the candidates is higher, being 24 years, as against 22 years in 1901.

There is a falling off in the number of candidates and papers submitted of about 30 per cent. as compared with 1901, but this was not unexpected, and is attributable partly to the experimental nature of the new scheme of examinations, and partly, no doubt, to the fact that many prospective candidates are preparing themselves for the severe ordeal which is now entailed in passing Parts II. and III. of the Fire branch of the examination.

The Executive had the pleasure last year of submitting to the Conference applications from the Institutes of Montreal and Toronto for affiliation with the Federation; and it is their pleasing duty to intimate a further and gratifying extension of the scope of the Federation at home by submitting an application from the recently formed Insurance Society of Edinburgh for incorporation in the Federation.

The finances of the Federation will require the careful attention of the Conference. Owing to recent amalgamations, the number of subscribing Offices is less than in former years, and the sum received has consequently suffered diminution. The revenue from sale of Journals and from Examination fees also shows a falling off, while the expenses are slightly increased.

The Executive desire to record their thanks to all who have contributed in any way to the success of the Federation during the past year, to the contributing Offices for their valuable financial assistance, to the managers of the Law Union and Crown, Sun Fire, and Standard Life Offices in London; the Liverpool and London and Globe and Century Offices in Edinburgh; the Hand-in-Hand in Leicester; and

the General in Perth for their kindness in placing rooms in their respective offices at the disposal of the Federation, and for their presence at the examinations as presiding officers; to the several gentlemen who kindly gave up their evenings during the examinations and presided at the various centres; to the large body of Examiners for the pains taken in preparing the examination papers and checking the 338 papers sent in by the candidates; to the Publications Committee for the enormous work they undertake year by year in the preparation of the Journal, selecting the papers, and seeing the work through the press; and to the President, the Secretaries to the Examiners, the Secretary to the Publications Committee, and the Hon. Treasurer for their respective services so cheerfully rendered.

The PRESIDENT'S address to the Conference was as follows:—Gentlemen, I take this—the first opportunity I have had—to express my most sincere and hearty thanks for the honour which was conferred on me in the city of Glasgow some twelve months ago, when I was elected President of the Federation of Insurance Institutes of Great Britain and Ireland for the session 1901-2. Such an honour any man in the profession might well be proud of; but when I think how little I had done to deserve it, how inadequately I have discharged the duties, and what little time I have been enabled to devote to the interest of the Federation, I feel a heavy sense of my own demerits and deeply regret that someone more deserving had not been selected. I may say that I feel this the more acutely because the present is the first occasion upon which the Emerald Isle—and Dublin, *the second city of the Empire*—have had the honour of being chosen as the meeting-place of the Federation, and therefore, in the hands of a more active and competent president, your deliberations here to-day would probably be productive of much more profitable results. Here I must beg to be allowed to make a slight digression.

My able predecessor in the chair at the meeting in Glasgow last year described that great centre of industry as *the second*

city in the Empire, and commercially speaking he was probably correct; but in justice to Dublin, and indeed to Edinburgh, I feel bound to supply a correction.

The three Metropolitan cities of the United Kingdom are London, Dublin, and Edinburgh—being the seats of Government in England, Ireland, and Scotland respectively. Dublin claims to be the second Metropolitan city in the Empire as possessing, next to London, the oldest charters from the English kings, and as being the seat of Government in Ireland since the reign of Henry II., and the Castle of Dublin being the residence of the Viceroys. Edinburgh ranks third, as Scotland did not come under English government until the reign of James I. of England and VI. of Scotland, when England and Scotland were united. The Lord Mayor of Dublin takes precedence of the Provost of Edinburgh at State receptions and in State processions. Likewise the "Ulster King-at-Arms" takes precedence of the "Lyon of Scotland."

It now remains for me to offer you all a sincere, hearty, and cordial welcome—an Irish *cead mille failthe*—a welcome in which my colleagues of the Insurance Institute of Ireland desire most warmly to be associated.

I trust that after the deliberations of this Conference have come to a close you will be able to visit some of the many places of attraction which Ireland offers to the sightseer and tourist. The International Exhibition at Cork will, I hope, attract many of you to the southern capital; and I am sure that those who may be able to spend a few days inspecting that magnificent and successful Exhibition will agree with me that our local patriotism, curious as its manifestations sometimes may seem, does not prevent Irishmen of all creeds from working together on industrial projects which promise to be of material advantage to their common country.

There they will have an opportunity of listening to those "Bells of Shandon that sound so grand on the charming waters of the river Lee," rendered famous by the celebrated Father Prout, and perhaps of seeing and of kissing that wondrous Stone whose very touch is said to inspire with eloquence—although from what I have observed among most

of my cross-channel friends they are already fairly well up in the art of Blarney.

It is a happy circumstance for the occupier of this chair that a long technical or elaborate address is not expected from him. The important matters with which the Conference will have to deal will demand all our energies, and which, I am convinced, will be earnestly devoted to their discussion. I congratulate the Federation upon the progress which has been already made in the work which we are here taking part in to-day, and upon the prospects for the future. We have made a steady advance, and though the goal which is our ultimate hope—the obtaining of a Royal Charter—may not yet be at hand, still, if we persevere, we must inevitably reach it in the end. Much serious labour has been bestowed upon our project by the pioneers who well and truly laid its foundations; and year by year we are making fresh friends at home, and in the Colonies as well, who are cordially joining with us in the great effort to secure for the world of Insurance its due place amongst the great commercial interests of our time.

Our work as a Federation may be divided into three heads—social, educational, and benevolent. With regard to the social side little need be said, for Insurance men are not lacking in those instincts that make for social good-fellowship. Our annual reunions have given great pleasure to those who have taken part in them, and I know sufficient of the hospitality of my Irish colleagues to have no doubt that this year's Conference will be not less successful in that respect than those of previous years.

But the chief work of the Federation—as the representative, the executive, of the Insurance Institutes of the United Kingdom—is, of course, educational. It is by its success or failure in this particular direction that it must stand or fall. I claim for the Federation that its educational work has been not only successful enough to justify the highest ambitions of its founders, but also to give some justification for the hopes which we entertain that this movement may more than realise the splendid prospects which the labour of its pioneers has opened out before us.

The educational work of the Federation has been of two kinds. In the first division I must class the production of the *Journal of the Federation of the Insurance Institutes of Great Britain and Ireland.* I think those who are the possessors of these volumes and those who are acquainted with their contents will heartily endorse the view that the Federation would have more than justified its existence if its sole work were the production of this Journal. I congratulate the Publishing Committee and the many laborious and conscientious contributors who have made the Journal a storehouse of information of great value to the men who at present are responsible for the transaction of Insurance business all over the English-speaking world, and of still greater value to those at present in subordinate positions, but upon whom, in the natural course of events, the management and control of this great business must ultimately devolve. I say all over the English-speaking world, for it is not only at home that this Journal is read with interest and profit. I am informed that the first volume, which was published four years ago at five shillings, is in great demand for Colonial Institutes at many times its published price.

While I hold that this Journal is the nucleus of a valuable, indeed, an invaluable, book of reference for Insurance men, I do not think that its excellence should make us remain satisfied with merely a nucleus. I should like to see in the various centres that may be regarded as most convenient good reference libraries, where those who are desirous of making a close and thorough study of their profession may find the best published works on the various classes of Insurance now practised, including actuarial work and such like. This would be a particular attraction and benefit to the younger members, who would thus be able to secure for reference and study volumes which would in many cases demand a greater outlay to purchase than individuals might be able to afford. A big book, according to the Greek proverb, is a big evil; a big library, on the other hand, is a boon that cannot well be over-estimated. This subject was referred to in the President's address at Bristol, and I hope it

will not be allowed to rest until something practical has been accomplished. I am pleased to notice that some of the members of our own Institute have contributed to these volumes, although I cannot help expressing regret that so few of the leading Insurance men in Dublin take any active interest in our organisation. This is unfortunate in many ways, because where the head of an Office ignores the existence of the Institute, in nine cases out of ten the members of his staff will do the same—"imitation is the sincerest flattery"—thus denying themselves of the opportunity of acquiring valuable knowledge of the business.

Of course we all feel that any personal benefits that may accrue from membership in improved training and business education must come to the younger members, and that has been admitted throughout; of course, too, we feel that a man who has attained in his profession the highest position open to him can hardly be expected to return from his home in the suburbs, after a hard day's work in his office, to hear every debate or every paper that may be read. Such is not really necessary, but an occasional attendance might well be afforded; and the encouragement which such attendances would give, the good example they would afford, could not fail to be of benefit to our Institutes.

I do not think that what one might call the miscellaneous branches of Insurance—such as Personal Accident, Workmen's Compensation, Third Party, Burglary, etc.—have received anything like the consideration which they are entitled to. Life and Fire, with their cognate subjects, appear to be the two which have almost monopolised our attention, and yet anyone engaged in Accident work, and in Workmen's Compensation business especially, knows that the routine of the Fire and Life Office is almost automatic compared with the work in his department.

But it is the carrying out of its examination scheme which is by far the most important work of the Federation. This scheme, as you are aware, had its origin in a resolution passed at the first meeting of the Federation. It was pointed out that during recent years accountants and architects had

followed the example set by what have been called the "learned professions," and made the passing of examinations a necessary preliminary to entrance into their ranks. It will surely be equally beneficial to the Insurance profession to be placed upon the same plane as the professions just mentioned, and nothing can be lost while much may be gained by the effective carrying out of schemes which aim at achieving this object. These examinations have not hitherto been as successful as might be wished, but this I think is due to reasons which need not present any very serious obstacles and may safely be left in the skilful hands of those who have them in charge. Under the new scheme, which came into operation for the first time in the examinations of April of this year, all that was changed, and changed, I think few will deny, for the better. The examinations under this scheme are divided into three parts—first, second, and final. Each of these three examinations deals with technical subjects, the preliminary examination in general knowledge being abandoned, because it was considered, perhaps rightly, that the Federation was scarcely the body to hold examinations in general knowledge. It is of course too soon to tell the full effect of these changes in the scheme of examination, but there are many signs that they are likely to produce a better result. I cannot too strongly urge upon the younger members of the Insurance world the desirability of presenting themselves for examination. It is true that the certificates of the Federation will not at once entitle them to an increase of salary. If they were to, I am not sure that I should be at all so satisfied as to their usefulness and value. These certificates are evidences that the holders of them mean to learn their business in real earnest, and not merely to play at Insurance. They will be of value for that reason, and of a value that cannot well be calculated in pounds, shillings, and pence. It is a value which will increase according as their possessors succeed in the business of Insurance, and the weight which Managers and Head Offices will attach to these certificates will depend largely upon the record of the men who hold them. Year by year the chief Offices are giving proofs that they appreciate the

work that is being done in improving and systematising the knowledge of their staffs, and the successful students at our examinations are not backward in acknowledging the benefits they have derived from their studies, nor, I am convinced, will they have long to wait before they find that their efforts have materially contributed to their success in life. The Managers and the Head Offices notice that the course of study necessary to pass these examinations necessitates a valuable mental discipline, and a widening interest in the various departments of the Insurance business.

These are qualities that cannot fail to carry weight when the claims of candidates for positions of responsibility are being considered.

There is one other aspect of the work of the Federation that I can heartily commend to your attention. I refer to the Orphanage Scheme. This scheme, as you know, owes its embodiment to the efforts of Mr. Albert D. Brookes, of Bristol, who has devoted a great deal of time and labour towards perfecting it. It relies for its support mainly on those engaged in Insurance business, and its benefits will be conferred exclusively upon the widows and orphans of Insurance men. Such a scheme requires no recommendation to you. It has been favourably spoken of by all my predecessors in this chair, and I warmly exhort the members of the Insurance body to sustain it in every way they can, while I would ask the chief Offices and local Institutes to give it all the support possible. In a poor country like Ireland, where Insurance officials are so inadequately remunerated, it may not receive the practical support it deserves, but by way of giving a good example I have pleasure to say that one of my Directors has promised to contribute ten guineas provided nine other gentlemen can be found in Ireland, within twelve months, to subscribe a like sum, *each*. This surely should not be a matter of much difficulty.

Before I conclude my address I should like to express the hope that that portion of our original education scheme which dealt with "certificates for essays relating to Insurance business and cognate subjects" may be taken up by the

various Institutes. Such essays would be of the utmost value in furthering our efforts to reduce the business of Insurance to a duly recognised service. There is nothing that will more readily contribute to an improvement in the practice of our business than a general discussion of the theory, and that can best be formulated by such essays.

I trust that the outcome of our deliberations at this Conference will be of substantial benefit to us all. In the growing stress of modern competition it is pleasant to have some common ground on which we may meet together, and I am sure that it will always be a cherished object of the Federation to promote feelings of mutual good-will and respect amongst those who are engaged in Insurance business. In this it has been eminently successful in the past, and there is good reason to believe that its sphere of usefulness will steadily expand, and that its benefits will continue to be exercised in an ever-widening circle.

*** *For all statements made, and opinions expressed, in the papers of this volume, the respective writers are alone responsible.*

LONDON MANCHESTER-WAREHOUSES.

At first sight there seems some inconsistency in calling a risk a London Manchester-Warehouse. It should, apparently, be one or the other; but, as a matter of fact, it may be both. The "London" part of the title refers to the situation of the warehouse, and the "Manchester" part to the class of goods stored in it.

We are informed by gentlemen from Manchester that the glory of their native place is its consistent humidity. They also tell us that cotton can only be satisfactorily spun and woven in a damp atmosphere. It results that the goods known as "Manchester goods" should, strictly speaking, be some manufactured form of cotton.

To avoid confusion it should be mentioned that the Manchester Warehouses Tariff applies to warehouses for textile materials within four miles of the Royal Exchange, Manchester, and, beyond the similarity of title, has no reference to warehouses for Manchester goods in London.

An historical study of the development of the London Manchester-Warehouses Tariff might prove most interesting, but only one who had special knowledge of the proceedings of the Fire Offices' Committee could write it satisfactorily. It will be safer for us, as surveyors, to give you such practical hints as we have acquired in applying the Tariff during the thirty-five years of its existence.

We cannot claim absolute finality for every opinion we shall express. We have differed, and probably shall differ, from other surveyors in some cases of speculative detail. Such differences can only be definitely settled by reference to the Fire Offices' Committee after they have arisen in respect of actual risks surveyed. When the point had been settled it might be discovered that the decision only referred to a particular instance and that in slightly different circumstances the whole question could be reargued and redecided.

Therefore those members of your Institute who hope shortly to pass examinations in the subject need not fear that we shall deal with it in such a manner as to rob them of the delight of further investigation. It would be presumptuous to suppose that we shall settle all the interesting questions that can arise in connection with the Tariff, but we hope to be able to suggest points worthy of such investigation. The course we intend to pursue is:—

1. To define the risks affected by the operation of the London Manchester-Warehouses Tariff.
2. To consider the area within which the Tariff applies.
3. To explain the method of computing the cubical contents fixing the class in which a risk should be rated.
4. To give details of features calling for additional rates.

And 5. To conclude with some general observations having regard more especially to losses in London Manchester-warehouses.

I. Definition of Risk.

It is a commonplace that the inventions of Arkwright and others, rendering possible the spinning of a cotton yarn, revolutionized the textile industries. Cotton could not be satisfactorily spun with the distaff and wheel, and, prior to the use of the mule and spinning jenny, it had been chiefly used, in the form of cotton wool and under the name of *bombast*, to puff out the quilted sleeves, doublets and breeches beloved of Elizabethan and Jacobean noblemen. In those days silk, linen, and woollen were the aristocrats of the fabric world. Shakespeare speaks scornfully of "*hempen* homespuns," and his contemporary, Greene, uses as a term of contempt the expression "to *bombast* out a blank verse."

But, however plebeian cotton may be, it is undoubtedly cheap, and, as a result, it frequently masquerades as, or enters into combination with more exalted material. *Cambric*, for instance, is described as a fine linen fabric bearing the same relation to linen as muslin does to calico, the latter being a cotton cloth. *Scotch cambric* is made of hard twisted cotton. *Flannel* is a woollen cloth of loose texture, but *flannelette* is entirely made of cotton. *Yorkshire broadcloth* sometimes contains as much as half cotton. *Mousseline de laine* has a cotton warp and a worsted weft. *Velvet* and *plush*, formerly entirely of silk, are now made sometimes partly of silk and partly of cotton. The *fustians*, such as corduroy

and moleskin, are wholly cotton fabrics, even though they be called stamped velvet or velveteen. Nor does cotton disdain alliance with less aristocratic material. Mixed with hemp or jute it becomes cloth, shirting, or garment linings.

It requires considerable technical experience and the assistance of a magnifying glass to tell whether some fabrics are made of the material they purport to be or of some less worthy substitute. It would evidently, therefore, be too much to suppose that an Insurance Company should scrutinize all the contents of a warehouse and declare whether any of them contained a proportion of that cotton which would strictly justify the application of the description "Manchester goods."

The Tariff in its heading settles the matter by including all material that might be partly of cotton. But a building in London in which such goods are stored is not invariably rateable under the London Manchester-Warehouses Tariff. In the first place it must be within one mile of the Royal Exchange. In the second it must be wholly or partly occupied as a warehouse or factory by a wholesale dealer. This evidently excludes a retail sale-shop which would come under the Shops Tariff, but a shop in which goods coming within the definition were stored and traded in wholesale as well as retail would be rateable under the London Manchester-Warehouses Tariff, except in the unlikely case of the rate under the Shops Tariff being the greater. The third point to notice is that the materials stored must be piece goods, threads, or yarns.

Generally, piece goods arrive at the warehouse in rolls of definite width, and of lengths varying from, say, 40 to 80 yards, maybe more and maybe less. A ticket attached to the roll will show the number of yards it has been invoiced at. Expensive silks and velvets are delivered in shorter lengths, packed in cardboard boxes, with the length marked on the outside. A warehouseman will divide these pieces if and as required by his customers, but the basis of all dealing will be the yard length, and a convenient definition of "piece goods" is material ultimately bought or sold by the yard. This definition must not be understood to exclude such articles as table cloths, table napkins, sheets, towels, blankets, or curtains. Although these may be bought and sold by number, they are priced according to the number of yards they contain, and must be considered as coming under the definition.

A doubt has been expressed whether a warehouse used merely

for depositing Manchester goods in bales as received from the manufacturer, and in which bulk was not broken and goods were not displayed to customers, would be rateable under the Tariff. The general opinion is that it would be. Warehousemen have sought to escape Tariff rating on the ground that bulk is broken and goods are exposed for sale, and that their premises are not, properly speaking, warehouses but only wholesale shops. This contention is not allowed.

Wholesale dealers in such textile fabrics, threads, and yarns as canvas machinery belting, bunting for ships' flags, ships' canvas, sailcloth, packing canvas, sacking, and matting, the yarns for making ropes and cordage, and the cloths specially manufactured for use by millers, printers, papermakers, and sugar refiners, sometimes escape rating under the Tariff, but these exemptions have been questioned.

It does not matter how small a part of a building is occupied as a warehouse within the Tariff, all the insurances on that building and its contents, no matter to whom the property belongs, are rateable under the Tariff. Thus a coffee-house keeper who occupied the ground and basement floors of a building used on the first floor as a wholesale milliner's workroom and showroom and on the remaining floors as a private dwelling was rated for his insurance on contents at the Tariff rate, which was about six times the ordinary premium for a coffee-house risk.

This provision of the Tariff frequently obviates the necessity for discussion whether a certain trade is, or is not, rateable under the Tariff. Umbrellas, for example, are specially included in the term "Manchester goods," but umbrella furniture—that is, only the sticks and metal parts of umbrellas—would not come under the definition. In a case we have in mind, the presence of other undoubted Manchester-warehousemen as tenants in the same building obviated all question.

The reversal of the conditions may render the state of affairs less comfortable. The weary surveyor who discovers, at the end of a long day's work, that a small room on the top floor of a large building, otherwise occupied by non-Tariff tenants, is let to a dealer in Manchester goods must recommence his survey to pick up the particulars necessary to satisfy the inquisitiveness of the Tariff form of questions.

Buildings in which Manchester goods are made up must be rated under the Tariff, as it is impossible for the process of

manufacture to be carried on unless a stock of material is kept on the premises. A small worker, who merely made up customers' orders for single articles, and kept no stock or samples, would not come into this category; nor would a retail tailor's shop, although cloth was stocked and work was done, provided only made-up garments were sold; but a tailor, who was also a wholesale dealer in cloth, would be subject to the Tariff.

A warehouse occupied by a wholesale dealer in articles manufactured from Manchester goods would also be rateable under the Tariff. Among such manufactured articles may be mentioned mantles, costumes, shirts, blouses, aprons,. pinafores, collars, neckties, scarves, stays, socks, stockings, jerseys, knitted articles, underclothing, clothing generally, cloth caps, and gloves.

The trimmings used to finish such articles would also be included, even though they were made of metal, ivory, bone, jet, fur, &c. Embroidery, lace, buttons, ribbon, bonnet ornaments, feathers, and artificial flowers must, in this connection, be considered Manchester goods. So would the bonnets and straw hats that might be trimmed with the last named materials; but felt hats would not, provided they were only trimmed with the usual band. A warehouse in which the principal stock was silk and felt hats, but in which a small quantity of straw hats, with no more than a single band each, was also occasionally kept, would, we think, escape Tariff rating. If felt hats trimmed with millinery, feathers, artificial flowers, or fur were kept, the warehouse should not escape.

Fur trimmings would extend to include a furrier's stock in general. Such goods would almost invariably be lined and sometimes stuffed with a material included in the term Manchester goods. A warehouse for fur skins, or a factory in which fur skins were dressed and dyed, would not be rateable under the Tariff; but a place in which fur skins were cut out and made up would, as a furrier's, be a London Manchester-warehouse.

In our definition of Manchester goods we have not yet mentioned haberdashery, carpets, Oriental goods, fancy goods, and toys. The instances already given would include most articles of haberdashery, either as goods sold ultimately by the yard or as trimmings; but sewing or crochet cotton, wool or worsted for knitting or mending, silk and flax thread, and tape must be added. A stock consisting entirely of needles and pins would not be considered Manchester goods.

Completed articles of furniture, in the manufacture of which cabinetmakers' work is a considerable part, are not Manchester goods; but such upholsterers' materials as wadding, furniture silk, repp, tapestry, velvet, trimmings, canvas, and American cloth are. Raw wool, flock, fibre, and leather are not. Silk, woollen, jute, and shoddy carpets or rugs are included, but fibre, reed, straw, and cork floor coverings are not. Linoleum and oilcloth might also escape.

A warehouse solely for boots and shoes is rateable under the "Boot and Shoe" Tariff, and not as a London Manchester-warehouse.

By far the greater part of the Oriental goods come from China and Japan. They include furniture, earthenware, metal work, embroidery, curtains, carpets, and ornaments. Fancy goods would include mixed stocks of small articles like photograph frames, fancy boxes, sachets, purses, hand-bags, blotters, and cigar or cigarette cases, napkin rings, and the many other flimsy things that are or may partly be made of silk, plush, cloth, fur, or imitation. A stock consisting wholly of either large wooden picture frames; of Christmas cards, oleographs, and engravings; of watches, clocks, and jewellery; of travelling bags and portmanteaux; of brushes and turnery; of china and glass; of walking sticks; or of hardware, need not be considered fancy goods. Small leather goods, tobacco pipes and tobacconists' sundries, celluloid articles, and stick mounts might be. Opinion is divided as to whether cricket, football, billiards, or lawn tennis requisites should be called toys. A risk confined to such requisites we should be inclined to exempt.

It is hardly necessary to point out that threads, yarns, carpets, fringe, trimmings, lace, embroidery, and furs are not restricted by the Tariff to piece goods. Threads, yarns, and tape sold by the hank, skein, reel, or ball; made carpet squares; lace or embroidery antimacassars, d'oyleys, table centres, and collars; fur muffs, boas, toques, and garments; and fringe or trimming ornaments and buttons, sold by number, would all be included.

This concludes a hasty definition of the goods dealt in by London Manchester-warehousemen. We have already seen that all warehouses in which such goods are stored, and all buildings where they undergo any process of manufacture, are rateable under the Tariff.

There are just a few other cases that require explanation. The

first is that of an agent in London for a manufacturer of Manchester goods. If he has an office in a building not otherwise rateable under the Tariff he will be exempt from its operation if he keeps no stock. The presence of such stock at any time renders the office a warehouse and the building in which it is contained subject to the Tariff.

Colonial merchants or shippers handling Manchester goods are also subject to the Tariff. A carrier handling such goods might be subject to the Tariff, or might be rated as a Railway Carrier. Pressers, packers, and finishers of such goods are also rated under the Tariff. So might be a linen shirt and collar dresser working for the trade. A pattern-card maker who stored Manchester goods to be cut up and mounted would be in a similar case.

To briefly summarize this part of our subject, we have seen that the strict definition of Manchester goods as goods wholly or partly made of cotton extends to cover all goods generally sold retail by drapers; that warehouses occupied by wholesale dealers in such goods, and factories in which such goods are handled or worked, are rateable under the Tariff; and that goods which are, or may be, partly composed of such materials are also intended to come within the operation of the Tariff; but that articles which are not and cannot be considered to come under those definitions, although, strictly speaking, they may be within the description of the Tariff heading, might not, in practice, be considered Manchester goods. There is an important reservation in respect to these exemptions. If a risk, which would not in practice be considered to be a Manchester-warehouse within the meaning of the Tariff, be in an area entirely surrounded by buildings which cannot, under the most specious pretences, escape the operation of the Tariff, then such a risk will be rated according to its contiguity, and not according to the usual application of practice.

The general rule, as we understand it, is that an ordinary risk adjoining a special risk is to be charged half the special risk rate, but in respect of London Manchester-warehouse risks the practice in such a case would be not to take advantage of any technical point to exclude a risk from the operation of the Tariff: on the contrary, to seek to bring it within such operation. On the other hand, an isolated risk in a district not generally devoted to London Manchester-warehouses would, we think, profit by the exemptions we have named.

The complicated character of the practical definition of London Manchester-warehouses has some analogy to the case of a conflict between Common and Statute Law. It is no doubt due to the desire of Insurance officials to be loyal to their Tariff obligations and, at the same time, not to be left behind in the keen competition for business.

II. Area Affected. We have already mentioned that a building to be rateable under the Tariff must be within one mile of the Royal Exchange. Our map shows the Royal Exchange and the parts of London within a radius of one mile from the middle point of that building. The circle might be extended a little by constantly making its centre the outside instead of the middle point of that building.

The question has been raised whether the Tariff applies to buildings outside the City of London. The Tariff was originally issued in 1867, or before London was made a county, and it has been suggested that a London Manchester-warehouse can only be a warehouse in the London of that time. The suggestion is ingenious, but in view of the very definite wording of the Tariff heading there can be no doubt that every risk coming under the definition and situate within one mile of the Royal Exchange must be rated at the Tariff rate.

The question whether a risk is within a mile of the Royal Exchange may considerably affect the basis of rating. A clothing factory within a mile of the Royal Exchange is rateable under the London Manchester-Warehouses Tariff, but outside that area under the Clothing Factories Tariff. A woollen warehouse within one mile of the Royal Exchange is also rateable under the London Manchester-Warehouses Tariff, but elsewhere in London it is apparently not rateable under a Tariff, being expressly excluded from the operation of the Woollen Warehouses Tariff. It may be as well to mention, in this connection, that although we have excluded wool warehouses from risks rateable under the London Manchester-Warehouses Tariff, certain specified wool warehouses are rateable under the London Mercantile Tariff.

Pursuing our plan of treating our subject practically, we will briefly refer to the various districts within one mile of the Royal Exchange, and endeavour to describe the characteristic risks in each district.

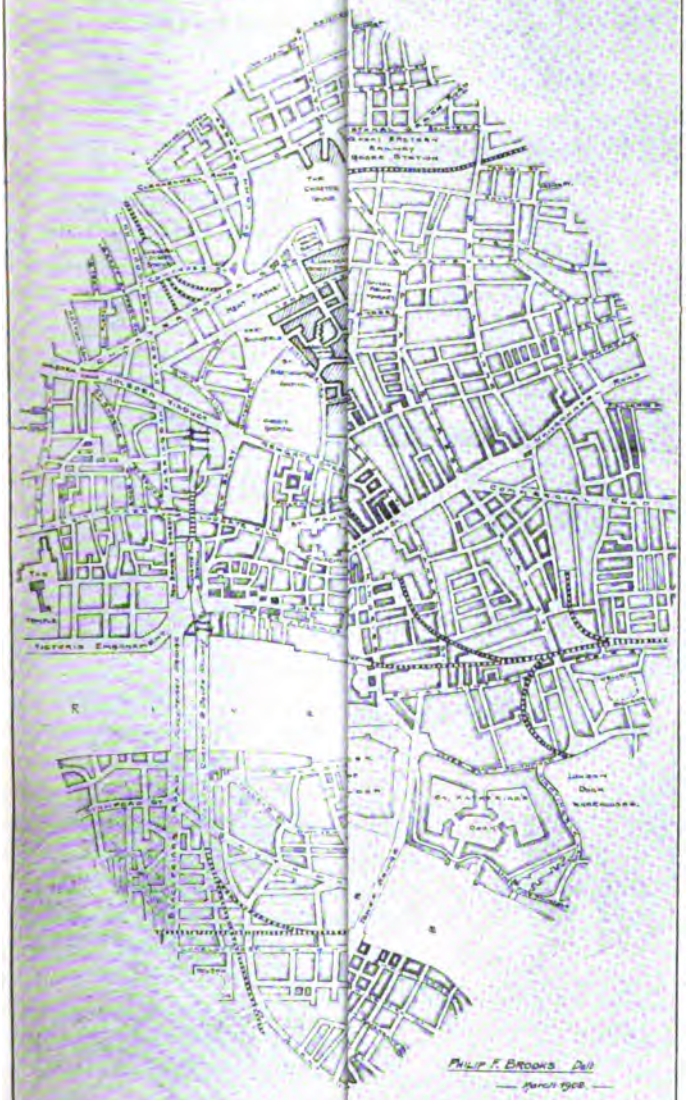
We commence with the south side of the Thames, as we have not, in our experience, known a London Manchester-warehouse

LONDON MANCHESTER - W

Sketch Map of

AREA AFFECTED

BLOCKS SPECIALLY R



risk on that side of the river. To the westward, in the Southwark and Blackfriars districts, printers' and stationers' risks may be called characteristic. To the eastward our circle passes just outside the Leather Market, which is the centre of the area affected by the Bermondsey Tanneries Tariff.

Crossing the river to the northward, our radius passes between the St. Katherine's and the London Docks. Dock warehouses, the public wharves, and warehouses generally on either side of the river are rated by the London Mercantile Tariff. We do not know any dock or riverside warehouse rated under the London Manchester-Warehouses Tariff. To the west of the docks are the Tower of London, Billingsgate Fish Market, and the Mark Lane and Mincing Lane districts, headquarters of the corn, tea, grocery, and dried fruit trades.

Going north again, our circle cuts through the Whitechapel and Spitalfields districts. Here are centres of the silk and clothing industries, and it becomes important to determine whether a risk in which such trade is carried on be within or without the mile radius. Many alien immigrants carry on small tailors', mantlemakers', and furriers' businesses in this district. Such risks will be rateable under the London Manchester-Warehouses Tariff if they are within the circle; but if they are outside it, and no power is used, not more than twenty hands are employed, and waterproof clothing is not made, they are not subject to a Tariff. It is hardly necessary to say that a great many of them do not insure. A toy or doll factory in this district, within the radius, would generally be rateable either at the Tariff or at a higher rate.

We next come to Finsbury and the Old Street district, largely devoted to the timber and cabinetmaking trades. Here, of course, the "Timber Tariff" is supreme, but warehouses for upholsterers' materials must be looked out for and, if necessary, rated as London Manchester-warehouses. We pass next to Clerkenwell and Hatton Garden, largely tenanted by dealers in precious stones, jewellers, gold and silver smiths, watch and clock makers or warehousemen, and dealers in china and glass. Discretion should be exercised in regard to fancy goods which may bring a risk within the operation of the Tariff. To the south-east we find the Central London Meat and Fish Markets, and, grouped around them, districts occupied by fresh or tinned meat and provision merchants. North and south of Fleet Street

are most of the great newspaper offices. Printing and paper industries take up a considerable part of this space, and extend across Farringdon Street as far as the Old Bailey. East of the Old Bailey, between Newgate Street and St. Paul's Churchyard, is Paternoster Row, the great book trade centre. Newgate Street contains several carpet, floor covering, and fancy goods warehouses. North of Newgate Street, and surrounding Bartholomew Close, are many printers and bookbinders. Between Ludgate Hill and Queen Victoria Street there are others. St. Paul's Churchyard is almost surrounded by London Manchester-warehouses, which overflow into the two districts last referred to.

We now enter the parts where those warehouses are crowded together most closely. We have distinguished, by cross-hatching on our map, those in which, owing to the great concentration of the class of risk we are specially considering, extra rates are chargeable. Wood Street may be taken as the centre. To the north is the Cripplegate area, unhappily celebrated as the scene of the last great City fire. The junction of Jewin Street and Aldersgate Street is largely occupied by furriers and feather dressers. Barbican and Fore Street contain many factories for millinery and the lighter kinds of garments. The isolated blocks round Charterhouse Buildings are similar risks. Golden Lane is partly devoted to boots and shoes, goods not rateable under the London Manchester-Warehouses Tariff. The district south of Watling Street, though not specially rated on account of concentration, also contains many Manchester-warehouses. In the narrow lanes beyond Queen Victoria Street are several packers, pressers, and finishers.

The parts surrounding the Bank and the Royal Exchange, and between them and the river, cannot be described as Manchester goods areas; but the space between Houndsditch and Leadenhall Street, centreing round St. Mary Axe, is largely covered with Oriental goods, fancy goods, and toy warehouses. As will be observed by the cross-hatching on the map, this is a concentrated area.

You will notice that, excluding the main arteries of traffic, the streets and lanes are not very wide—many of them, indeed, less than 20 feet—and that there are very few open spaces. This is not surprising when you consider that the value of freehold land in the City of London may be as much as from £40 to £50 per superficial foot, or at the rate of nearly £2,000,000 per acre.

In the buildings so crowded together, goods of considerable value are often packed, so that the amount at risk may, in ordinary cases, work out to as much as £200 per square foot of ground covered, and, in the case of such expensive commodities as real silks, to even more. Nor must it be supposed that the Manchester-warehouses are invariably divided from each other by risks of another class. In Wood Street the buildings are numbered up to 130, but it does not appear that more than eight of them, including a church and a public-house, could escape rating as London Manchester-warehouses.

Another point bearing on this concentration is the large number of tenants occupying, and the different classes of trade carried on in some of the buildings within the area. We may instance a building let out to 32 tenants as warehousemen for silk, stuff, sewing silk, corsets, stationery, linen, haberdashery, flannel, woollen, hats, clothing, and trimmings, besides a pattern-card maker, using gas-heated glue pots, pressing irons, and a paper-cutting machine; a stockbroker, and a railway receiving office of considerable extent. It is quite common to find a printer, a picture-frame maker, or a walking-stick manufacturer carrying on business in a small part of a building otherwise entirely occupied by a large number of Manchester-warehousemen.

Owing partly to the great value of premises in central positions in the City of London, and partly to the requirements of the authorities relating to buildings, or parts of buildings, used as factories, the tendency of late years has been, as far as possible, to remove manufacturing businesses or departments either from the centre of the City to its outskirts, or even to the suburbs and small towns within easy reach of London. This has been most marked in the printing industry, but it has also affected the London Manchester trades. The freeing of sites on the outskirts of the City, either by fire, as in the case of the City Soap Works, or by the demolition of old dwellings, as in the case of streets about Golden Lane, has led to the foundation of new manufacturing districts. The more central risks have thus been changed in some measure from the mixed class of warehouse and factory in single tenure to warehouses occupied by mixed tenants.

Another alteration worthy of notice is taking place in St. Mary Axe, referred to as a centre of the Oriental and fancy goods trades. The Baltic, formerly in Threadneedle Street, has been moved to St. Mary Axe, and the banks that do business with it

are displacing the warehouses, and turning them into branch banking establishments.

The construction of the more modern buildings is generally fairly substantial, when the rage for huge expenses of glass and complicated webs of ironwork has been resisted; but at the back of Ludgate Hill Station, round Paternoster Row, in parts of Aldersgate Street, of Little Britain, and of the Houndsditch area, to the north of Fleet Street, and in the Aldgate and Spitalfields districts, are many small and old buildings which require careful consideration by a qualified surveyor. We had occasion to remark, in our paper on "Building Construction" read before this Institute, upon the danger of hidden defects, and the method of gauging them. This is a matter requiring a trained eye and a decided mind.

In concluding our remarks on the area affected by the Tariff, we must emphasise our point that in those districts, where London Manchester risks are in the majority (and, as we have seen, they almost monopolise some parts of the City of London), it would be most unwise to relax the stringency of any of the provisions of the Tariff, but where such a risk stands alone it might, in practice, benefit from any uncertainty as to the intention of the provisions.

III. Cubical Contents.

The rate of premium for an insurance under the London Manchester - Warehouses Tariff depends upon the cubical contents of, and the presence or absence of certain specified features in the building.

This Tariff is not the only one in which the cubical contents affect the rate. Under the "Cold Storage Warehouses" Tariff, unless a cubic capacity of 20,000 feet used for cold storing is reached, Tariff rating is escaped. Under the "Furniture Stores" Tariff, if the cubical contents exceed 150,000 feet, the risk must be specially considered by the Fire Offices' Committee. Under the "Glasgow General," the "Glasgow Mercantile," and the "Leith and Granton" Tariffs there is an additional rate if the cubical contents exceed 200,000 feet. Under the "Woollen Warehouses" Tariff, that part of the "London Mercantile" Tariff referring to granaries, and the "London Manchester-Warehouses" Tariff, risks are divided into classes according to their cubical contents.

There are three such classes under the Tariff we are now considering. The first includes those buildings whose contents do not exceed 100,000 cubic feet, the second those whose contents exceed 100,000 but do not exceed 216,000 cubic feet, and the third those whose contents exceed 216,000 cubic feet. The class into which the risk falls affects not only the normal rate, but also the additional rates for special features to which we shall next refer. In the case of warehouses exceeding 216,000 cubic feet, the additional rates for special features do not vary, but for every 100,000 cubic feet, or fractional part of 100,000 cubic feet, above 300,000 cubic feet, an extra rate is chargeable on account of cubical contents alone.

The limit of 216,000 cubic feet to the second class is that fixed by the Metropolitan Buildings Act of 1855 as the cubical extent of an undivided building. It has been extended by the London Building Act of 1894 to 250,000 cubic feet.

The method prescribed for calculating the cubical contents of a London Manchester-warehouse differs from those laid down in the Act of Parliament and in the general rules of the Fire Offices' Committee. The London Building Act of 1894 defines the cubical extent of a building as "the space contained within the external surfaces of its walls and roof and the upper surface of the floor of its lowest storey." For the purposes of the Act heights must be measured. Under the general rules of the Fire Offices' Committee the whole surface area, including half the party walls and the whole of the external walls, is to be measured, but the height of each storey is to be taken as 10 feet.

Under the London Manchester-Warehouses Tariff the area is taken *within* the external and party walls. By a strange anomaly, the recently issued Rules for Standard Fire-Resisting Buildings required that the cubical contents of any one compartment of a London Manchester-warehouse claiming a discount under those rules should not exceed 60,000 feet, and, in calculating those contents, half the party walls and all the external walls were to be included in the area, and actual heights were to be measured. This might have necessitated separate calculations in a case where there was a doubt whether a building was entitled to be described as Standard Fire-Resisting, but, by a revised notice, dated as late as the 10th of this month, the system of measurement is conformed in spirit, though not in word, to that of the Tariff we are considering, so far as the area is concerned; actual heights

are to be measured, and, as we shall see, in this respect the rules are still discrepant.

In order to show clearly the method of calculating the cubical contents under the London Manchester-Warehouses Tariff, we have prepared a plan of an actual warehouse (*see* Fig. 1). In simple cases the calculation can be effected without making a plan, but in the case of a building like that shown on our drawing, where the site is so irregular and the number of floors so variable, it would be dangerous to attempt it without having measured a plan in careful detail.

The Tariff form of questions requires the area of the warehouse on the ground floor, the number of storeys, and the cubical contents to be stated. If this is meant to be a check on the surveyor, it casts an unmerited slur on the ingenuity of our profession, for to state a ground floor area and number of storeys incompatible with the calculated cubical contents would prove the possession of an unpardonably slovenly imagination. It is by no means unusual in other Offices than our own to bracket these three questions together, and to reply simply "Under 100,000," or "Under 216,000" feet, &c.

The warehouse shown on our plan, Fig. 1, consists of a sub-basement, a basement, and ground floors over the whole site, but the number of storeys above the ground floor varies, and the variation is shown by the figures in circles. Thus the part marked (3) has a skylight over the ground floor, and is lighted from an area. The octagonal part marked (5) has a large skylight over the second floor, the parts marked (6) have the roof over the third floor of those portions, and the parts marked (7) are the highest, the roof being over the fourth floor.

The thicknesses of external and party walls are not shown on the plan, as they concern neither the area nor the cubical contents of the building under the Tariff regulations. The areas of the pier at N and of the projections at O, P, Q, R should not be included, but the areas of the recesses at S and T must be. Supposing there were a wall crossing from F to E, with free communications therein, the area of the wall, as well as of the openings, would have to be measured in, and, similarly, no deduction may be made for the pier at U carrying the enclosing walls of the light area, as it is no part of the external or party walls. The space H, I, K, L used in the actual warehouse as the well-hole for a lift, must, of course, be measured in. Guided by these

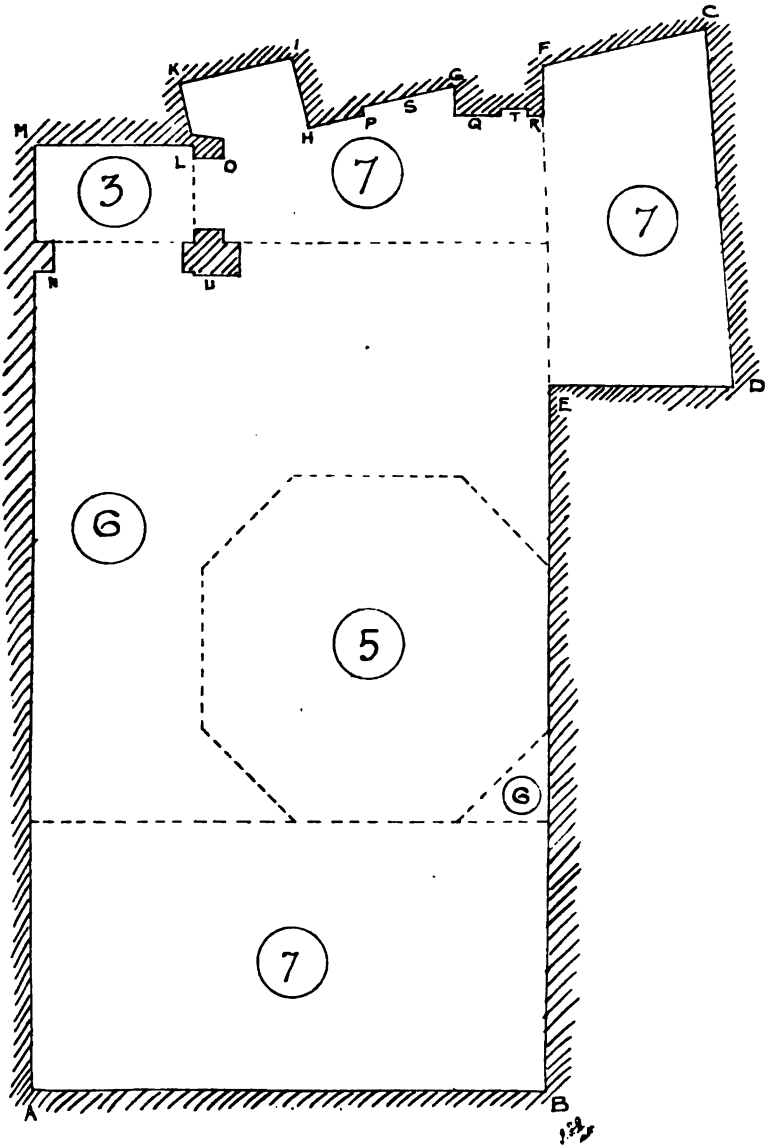


FIG: 1.

principles, the calculation of the area of the ground floor is a simple problem in mensuration.

With regard to the other floors a few remarks are necessary. If, as is not at all unusual in London warehouses, the basement projected beyond the external walls of the ground floor, extending in vaults under the street pavement or a yard, or if it did not extend over the whole site, an addition or deduction, as the case might be, to or from the area of the ground floor would have to be made in order to calculate the cubical contents of the basement. In any case, the contents of the basement must be included, as the rule exempting basements, the ceilings of which are not more than three feet above the lowest ground level, only applies in certain cases where the number of floors is the subject of rating, and not where, as in this case, the number of floors is only taken as a means of arriving at the cubical contents. It seems a question whether vaults under a street pavement or yard, approached only across an open area outside the external wall of the warehouse, and having doors fitted to all the openings from the warehouse into the open area, and from the area to the vaults, would have to be included.

In taking the area of the first floor and the floors above it, the light area M, N, U, O, and the walls enclosing it will not be included, nor will the parts above the octagonal skylight with the walls on seven sides of it. The party wall on the eighth side was not included in the area of the ground floor. No deductions may be made for voids in any of the floors, such as openings for staircases or lifts, well-holes for light, or fireplace hearths; but chimney breasts come under the same rule as projections, provided they are in external and party walls, and should not be included.

When the areas of the different floors vary, it is very necessary to be satisfied why they do so, for, if a floor extends over or under part of another building, and is not of fireproof construction, there will be a communication necessitating the inclusion in the cubical contents of the communicating building.

The mere fact of a communicating building being occupied by a tenant not rateable under the London Manchester-Warehouses Tariff would no more justify the exclusion of that building from the cubical contents than the occupation of a floor of a building, partly used as a Tariff warehouse, by a tenant not subject to the Tariff would justify the exclusion of that floor. Basements must, as we have seen, be added, and so must attics. It does not matter

whether a floor goes over the whole building or not, provided it might be included within the external and party walls. In this connection a wall carried on a girder, or a skylight, either of which had one face exposed to the outer air, would be considered external. But we should exempt from this definition of a floor a very narrow gallery only used for obtaining access to fixtures in which small goods, such as gloves, were stored, and a few single boards running along the tie beams of a roof to facilitate the inspection of a cistern. The space between a ceiling and a roof, in which there was no floor, which was unused, and access to which was obtained solely by a trap door, would not be considered a floor; but a loft in a roof, even though it were only approached by a step ladder and only used for storing lumber, would be a floor.

The height of each floor must be taken as ten feet, except in the case of a floor having a sloping roof, where a deduction may be made for the part where the height is less than ten feet, but no addition need be made for a part that is more than ten feet high. If part of the roof were sloping and part horizontal, the height from the floor to the horizontal part being less than ten feet, the deduction could only be made on account of the sloping part. Supposing that in Fig. 3 there were a flat ceiling eight feet

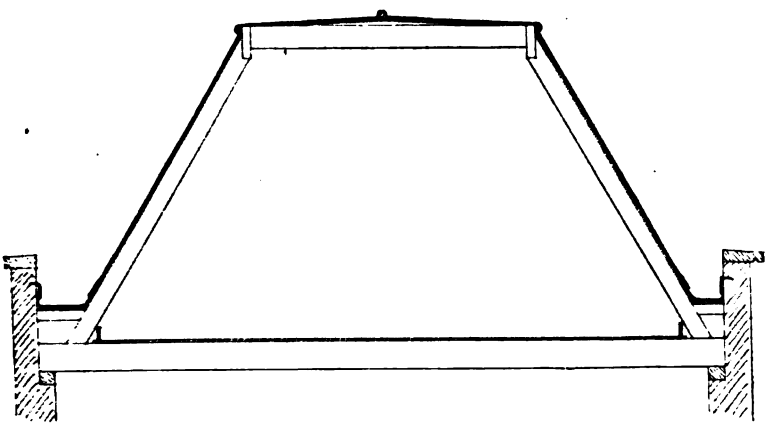


FIG: 2

from the floor, no deduction could, apparently, be made, as the storey cannot be said to have a sloping roof although the building has. If, on the other hand, there were no ceiling, or the ceiling ran close under the sloping rafters, deduction could be made for

the parts less than ten feet high. In the case of the mansard roof (Fig. 2) deduction could be made for the sloping cheeks, but not,

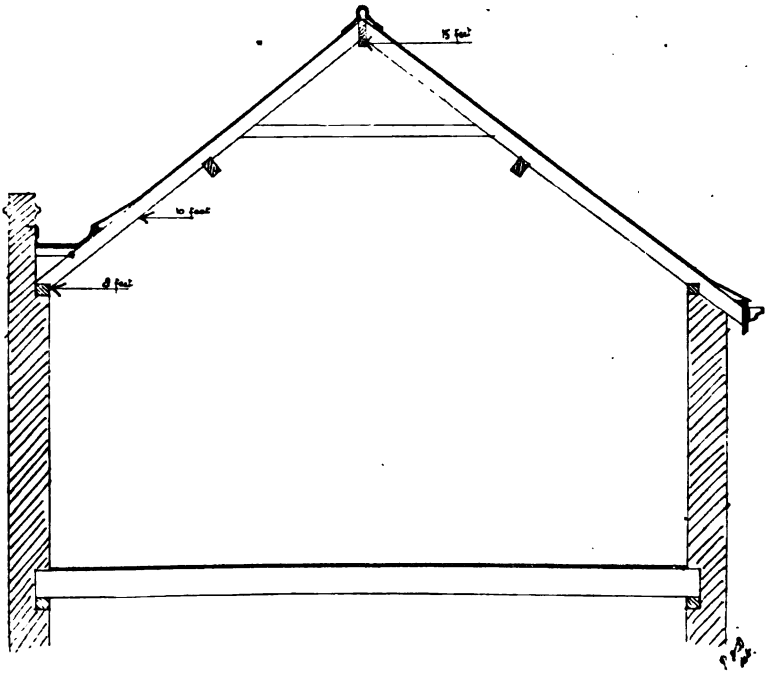


Fig. 3

apparently, for the centre part, although it were less than ten feet high. The Tariff is not clear on these points. It says "due deduction may be made for any storey or storeys having a sloping roof." The questions naturally arise, What can be considered "due deduction," and What is a "sloping roof"? For convenience sake some roofs are spoken of as flat roofs, but, as we pointed out in our paper on "Building Construction," referring to flat roofs, "the covering must always be somewhat inclined, in order that water may not stand upon it," and it follows that actually all roofs are more or less sloping. We have given a literal reading to the various prescriptions, but there is evidently room for an exercise of judgment in applying our principles.

Reverting to our plan of a warehouse (Fig. 1), it will be seen that the greatest number of floors is seven. We can therefore compute the cubical contents by multiplying the area of the

ground floor by 70, adding extensions of the basement, if any, and deducting those parts which are less than seven floors high, or, as was actually done in this case, we can take the areas of the various parts that have an equal number of floors separately, and multiply by 30, 50, 60, or 70 as the case may be. The addition together of the separate areas will give the area of the ground floor, and the addition of the separate areas multiplied by the respective number of floors and by ten will give the cubical contents.

We have already mentioned that in the case of buildings freely communicating the aggregate cubical contents of all the communicating buildings, of the walls dividing them, and of the openings of communication, must be taken. This is of course merely the application of the common principle that communicating buildings must be considered one risk. The only exception is in the case of an aperture no larger than is absolutely necessary for the passage of electric lighting conductors. Any other opening in a wall must be considered a communication.

In the case of buildings communicating only by double fireproof doors, which under the Tariff may be 8 feet high instead of 7 feet, as prescribed by the General Rules of the Fire Offices' Committee, if the aggregate cubical contents do not exceed 216,000 cubic feet, the communicating buildings may be rated as separate risks. If the aggregate cubical contents exceed 216,000 feet, then the normal rate for each building would be the normal rate chargeable for the largest of them, but in no case less than if the largest of them exceeded 216,000 cubic feet, and the additional rates chargeable for special features in either of the communicating buildings would be chargeable for each of them.

Under the London Building Act of 1894 buildings must not be made to communicate unless they are, or are constructed or adapted to be, wholly in one occupation. Openings in walls dividing buildings which, taken together, would extend to more than 250,000 cubic feet, must not be more than 7 feet wide or 8 feet high, and must be protected by double iron doors. The communications between buildings which have ceased to be in one occupation must be bricked up. Buildings in conformity with the regulations in force at the time of the passing of the London Building Act are exempt from the operation of these provisions.

In the case of three buildings which communicated only by double iron doors on the three topmost storeys, the said storeys having been wholly in one occupation before the passing of the

Act of Parliament, and having remained so ever since, and the lower floors not communicating, and let off to several tenants, where the proposal was from a tenant of a lower floor in one of the buildings, the cubical contents of each of the three buildings and of the division walls had to be taken. The normal rate was that for a building of the aggregate cubical contents which would not be considered to exceed 300,000 cubic feet, and the rates for special features in either of the three buildings had to be added.

Buildings communicating only by double fireproof doors across a fireproof compartment are measured and rated as separate risks.

There is one other point concerning cubical contents to be mentioned. Referring to our plan (Fig. 1) once more, and supposing that a solid brick wall, of proper thickness and without openings, were built up from the ground on the dotted line E F, and a fireproof floor, without openings, covered the whole portion E, D, C, F at, say, the first floor level, then that portion could be rated as a separate warehouse, although there were free communications with the other parts on the upper floors. Lock-up shops and basements used for Tariff trades, but enclosed with proper brick walls and fireproof floors, are rated as self-contained risks.

IV. Additional Rates.

In dealing with the special features of risk which call for additional rates under the Tariff it will be convenient also to touch on the recently issued Rules for Standard Fire-resisting Buildings so far as they are applicable, but as the rules may not be quite decisive it will not be necessary to treat them very exhaustively.

Construction.—To escape an additional charge the external and party walls must be "entirely of massive construction." That means in accordance with the definition of the General Rules. There is no limit of thickness, and a front chiefly composed of glass would be considered "massive." It is not very usual to find examples of imperfect external and party walls in the City of London, but we have had to make the extra charge because parts of external walls have been built of stud and plaster, or of weather-boarding. The discovery of a portion of a party wall so constructed is a matter calling for acuteness on the part of a surveyor, especially if it happen to be at the back of a well-filled cupboard. In the case of Fire-resisting Buildings the thickness

of brick walls must be 13 inches, of concrete walls 20 inches, and stone walls are to have a backing of brick 13 inches thick.

No extra rate is set down for imperfect construction of roofs. We do not remember an example of a roof that would not be allowed by the General Rules in a London Manchester-warehouse, except such glass roofs as would be charged the additional rate for skylights. The curb of a mansard roof (see Fig. 2) would not be considered an unmassive external wall, although it were only constructed of slates or metal on studding and boarding, but, under certain circumstances, it might be treated as an unmassive party wall. Roofs in Fire-resisting Buildings must be constructed like fireproof floors.

Party walls must be carried through and above the roof at all points. The height they must be carried above is not specified. We do not remember having had to make an extra charge on this account in recent years. The height of party walls above the roof in Fire-resisting Buildings must be three feet. The London Building Act prescribes this height for buildings of the warehouse class more than 30 feet high.

Skylights.—Skylights or glass roofs call for an additional rate whether they be over the topmost or any other floor of the warehouse. One skylight, not exceeding 20 superficial feet in area, and used only for lighting a staircase is allowed, without charge, provided it is protected by a galvanized wire guard of specified pattern; but it seems clear that if there were two skylights, not together exceeding 20 feet, whether they were constructed to light one or two staircases in one warehouse, the additional rate would be chargeable. The case of a W.C. approached from a staircase or landing but not directly from the warehouse, and lighted by a skylight within the limit of size and properly protected, there being no other skylight or glass roof, seems rather a hard one, but the additional rate must apparently be charged. In Fire-resisting Buildings glass ¼-inch thick in sections not exceeding 36 superficial inches, or wired glass in sections not exceeding 144 superficial inches, set in metal, is allowed, but no other form of skylight.

Ironwork.—Structural ironwork must be covered with brick, plaster, or cement at least ¾-inch thick. It will be necessary to discriminate between ironwork which is structural and that which is not. A youthful and enthusiastic surveyor once sought to charge the heavy framework of a hydraulic press which happened

to be fixed to the floor of a room at one end and to the ceiling at the other as unprotected iron columns. A small girder used only to carry the inside of a street pavement light can hardly be called structural ironwork. In a similar way we should exempt most of the ironwork in connection with a staircase or a lift, and certainly all ironwork solely in connection with machinery or fittings. Iron columns or stanchions carrying the springer of window arches are undoubtedly structural, but a small iron column placed in front of a brick pier between windows has been considered to be ornamental and not structural.

Before reading the recently published Rules for Fire-resisting Buildings we had written "a covering of earthenware, terra-cotta, or fireclay not applied in a plastic state will not meet the Tariff requirements." We instanced in our paper on "Building Construction" the danger of a "hypocritical granite garment hung round an iron column or girder," and we have little faith in any similar garment unless it be very close fitting; but the new Rules for Fire-resisting Buildings allow a casing of porous terra-cotta (at least two inches thick) securely anchored. We understand that this porous terra-cotta is a new material of French manufacture, through which air, expanded by heat, could escape without causing the terra-cotta to crack. It is quite evident the additional charge could not, in view of the later rules, be made under the original Tariff for ironwork so protected.

The question whether ironwork is sufficiently protected is one of some difficulty, as mere inspection of the finished work will not afford conclusive evidence on the point. The pocket-knife test is difficult of application, and meets with reasonable objection on the part of a proposer. Again, girders, columns, and stanchions are frequently cased in matched or other boarding, and even a surveyor has not the powers of vision admiringly referred to in the evidence given by Mr. Samuel Weller at a celebrated trial. It is generally safe to infer that ironwork cased in boarding is not otherwise protected, but charging the boarding as wood linings would not justify the omission of the charge for ironwork.

Wood Linings.—All rooms, passages, and the under-sides of staircases and landings must be ceiled with plaster, unless the floor over is of fireproof construction, or is formed of timbers bolted together and at least four inches thick. There must be no linings of wood, canvas, or paper to any parts of the walls or ceilings. An attic storey in which the rafters and roof covering

are exposed on the under-side, or concealed with boarding, calls for an additional rate as not complying with these requirements; so would ordinary paper hung on plastered walls. The General Rules allow paper linings in close contact with the wood under-sides of floors, but this does not affect our Tariff, as the additional rate in such a case would still be chargeable because there was no plastered ceiling. Wooden dados not more than five feet high are allowed. It is six feet in the General Rules. So are boards or battens used to protect the sides of openings through which goods are hoisted or lowered. A wooden partition enclosing a staircase would not be chargeable, but if the staircase were enclosed in walls, and the walls were lined with wood, then an addition to the rate would have to be made. It seems doubtful whether a step-ladder could be considered a staircase, and whether the extra rate could be charged because its under-side was not ceiled with plaster. In many buildings wholly or partly used as factories the London County Council cause a fire-resisting staircase to be erected. Such a staircase may be of oak, teak, or other hard timber, with treads, strings, and risers not less than two inches thick. If the under-sides of the steps were unplastered the extra rate would certainly be chargeable, but we doubt whether it would be charged. Wood linings entirely covered with fibrous plaster are allowed, and the extra rate on account of the exposed under-sides of rafters and roof covering could be saved by covering them in that way.

Well Hole.—If there be any opening in a floor either for hoisting or lowering goods, for any means of communication, for lighting, or for ventilation the rate must be increased. It does not matter whether the openings are glazed or protected by flaps, even, presumably, although the flaps were of metal, or metal covered, but of course in no case could a glazed opening be charged both as a skylight and under this head. A trap-door in a plastered ceiling giving access to a roof would not be charged either as a floor opening or as a wood lining.

A glazed floor opening not exceeding two feet superficial, and glazed with thick plate glass is allowed. No thickness is specified, but plate glass is usually about a quarter of an inch thick. Plain or rolled plate glass, or the roughly cast forms usually used in pavement lights, would be sufficient if they were of that thickness. Sheet glass of however great weight would be inadmissible.

A staircase not enclosed in incombustible material is chargeable

as a floor opening. In this connection an ordinary lath and plaster partition, or presumably one of the new metal and plaster partitions, is considered incombustible material, provided all the openings are protected by doors. The doors may be of wood or may have glazed upper panels. This charge for staircases not enclosed in incombustible material was first introduced in 1890, but the proviso allowing a lath and plaster partition was not in the first edition of the Tariff of that year, and its subsequent addition necessitated the revision of a number of reports.

Additional rates are by the General Rules declared to be cumulative, but a skylight, an unenclosed cast-iron staircase, a floor light, or a flap, would not be charged for as a special feature on its own account, and, again, because its underside was not ceiled with plaster. An unenclosed wood staircase might be charged for twice if its underside were not ceiled with plaster.

A floor opening only large enough for the passage of the starting rope of a hoist outside the building is allowed.

In a Fire-resisting building no lining of wood or textile fabric is allowed. This implies the allowance of ordinary paper-hangings on plaster. In such a building no floor openings are allowed, except for the passage of pipes, shafting, and electric conductors, and those only conditionally. Staircases and lifts must be enclosed in walls having fireproof or hardwood doors.

Windows.—The warehouse must not have any opening in its outer walls into an area, court, or passage common to other buildings, or within 20 feet, in any direction, of a similar opening in another building, or within 10 feet, in any direction, of the roof of another building. The additional rate for this feature might be saved by protecting the openings in the building to be rated by iron shutters or fireproof doors of prescribed pattern. It must be charged if only the openings in the other building are protected. If the other building be occupied entirely as a private dwelling or offices it would not be charged, even though the openings in neither building were protected.

The term "opening" applies to any kind of door, window, or skylight, but it would not apply to a feature already charged as "imperfect construction." The fact that a skylight had already been charged for as a glass roof would not entitle it to escape this charge if there were opposing openings within 20 feet of it, or a roof within 10 feet of it belonging to another building; but it

might escape if it merely looked into an area, court, or passage common to two or more buildings.

To give practical illustration of the principles followed in applying the rules for this additional rate we refer again to Fig. 1.

There is a skylight over the second floor of the octagon, and windows in seven sides of the octagon, all belonging to our warehouse, within 20 feet of each other and of the skylight, but there are no openings in the party wall forming the eighth side of the octagon. Therefore the area is not common to the two buildings, and the rate for windows is not chargeable. But there are openings in each of the buildings abutting on the area marked (3) within 20 feet of each other and of a skylight, and in this instance the additional rate is called for.

It seems evident that warehouses having openings into a churchyard or into one of the Livery Companies' gardens common to openings in other buildings would not necessarily pay the additional rate. We may pass by the question whether the hall of a Livery Company or a church could be considered wholly in private or official occupation. The point is: Under what circumstances could a garden or churchyard be considered an area, passage, or court within the meaning of this section of the Tariff? Would opposing openings 50 feet apart be chargeable? The limit of 20 feet fixed by the second paragraph of the section would certainly apply in the case of openings opposing across a public street, and there seems no reason why a street should be more favourably treated than a churchyard or garden. To carry this argument a little further, suppose there were no other openings in the warehouse (Plan, Fig. 1) looking into area (3) but the skylight, and that the windows in the adjoining buildings were more than 20 feet away from it, would the additional rate be chargeable? We think not.

The mere fact of two buildings having windows into a common area evidently does not necessarily call for the additional rate. If both the windows are on one side of a common area (as in Fig. 4), and there are no other openings into the area, the case is specially exempt. If either of the windows were bowed in one of the forms shown in Figs. 5 and 6, we should be inclined to consider the extra rate applicable, and if each of them was bowed we should certainly think so.

If two separate buildings having openings liable to be charged

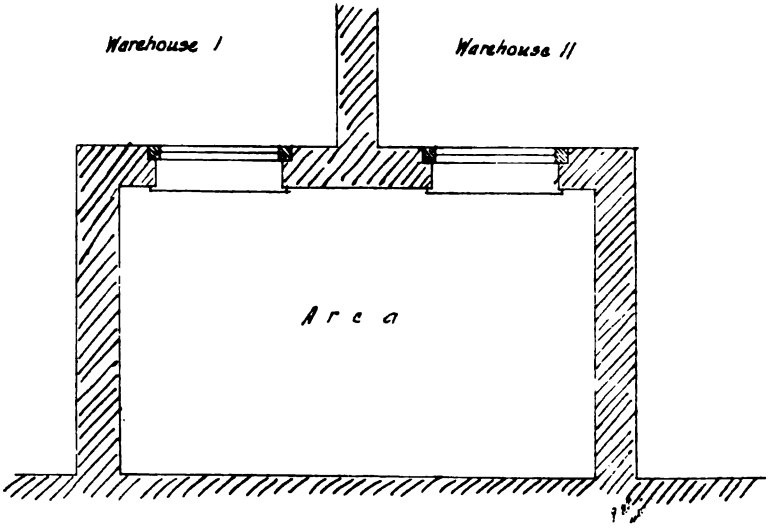

Warehouse I
Warehouse II
Area

Fig. 4

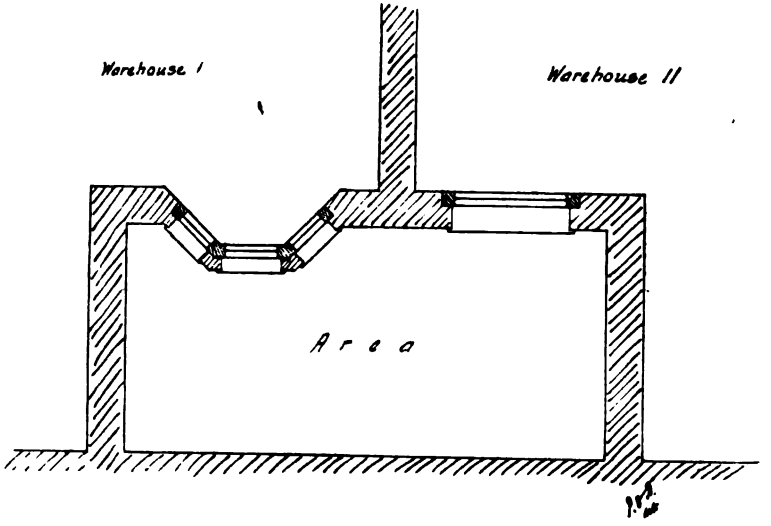

Warehouse I
Warehouse II
Area

Fig: 5

for in respect of each other were made to freely communicate, the additional rate would be unnecessary, as the two buildings would. for rating purposes, have become one.

Openings in two buildings communicating only by double fire-proof doors would be chargeable if the aggregate cubical contents were less than 216,000 feet, as the buildings would then be deemed and rated as separate risks; but if the aggregate cubical contents exceeded 216,000 feet the two buildings would be similarly rated, and it would be inequitable to charge for opposing openings as between those two buildings only.

Openings in Fire-resisting buildings within 20 feet of openings

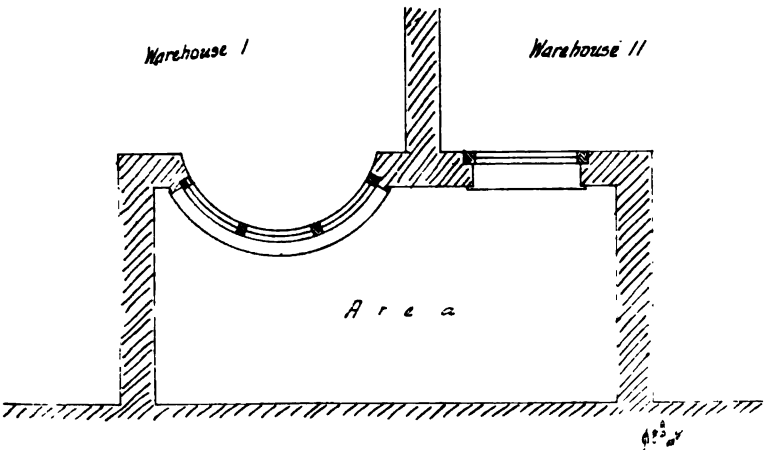


Fig: G

in other buildings must be protected. Openings into areas, courts, or passages are not specifically mentioned.

Tenants.—A warehouse not wholly in one occupation pays an additional rate if there be more than one, but not more than four tenants. The additional rate will be heavier if there are more than four tenants. The differential rating for this feature was an innovation in the Tariff of 1890. The fact that an occupier does not carry on a trade rateable under the Tariff is no reason why his tenancy should be ignored. The only exemptions are on account of tenants occupying solely as a private dwelling or offices. A tenant carrying on two trades, one rateable under the Tariff and the other not so rateable, need not be counted twice.

Stove.—A stove or furnace having more than 6 feet of smoke pipe or a drying-room calls for an extra rate. An earthenware smoke pipe would be equally chargeable with a metal one. A room for drying by air at the normal temperature would not be chargeable. The construction, number, and size of rateable pipe stoves and drying-rooms are not referred to in the Tariff.

Work.—There are additional rates in the event of any work, except labelling, packing, and pattern-cutting being carried on in a building subject to the operation of the Tariff. One rate applies in the case power is used, and a less rate if no power is used. Both these additional rates and the one last referred to were first introduced in the Tariff of 1890. "Power" includes that derived from steam, wind, and water, gas and oil engines, and electro-motors. The use of water power for working a lift would not be chargeable. The only work that can be charged for is such as might be carried on in connection with a trade rateable under the Tariff. It cannot be exempted because it is actually carried on by a tenant whose trade is not subject to the Tariff. Work that would only be done in a trade outside the Tariff, even though it were of a more hazardous nature than might be carried on under the Tariff, would not be chargeable. For instance, the partial occupation of a building by a working carpenter, packing-case maker, or printer would not alone justify the addition of the charge for work, but the employment of a carpenter by an Oriental or fancy goods dealer to repair his stock or of a printer to print a warehouseman's labels would.

Packing is allowed, and must be taken to include unpacking. The placing together of the parts of Oriental or fancy goods taken to pieces for convenience of transport could thus be permitted. The work done by a cloth packer would also escape, nor would the use of a Bramah hydraulic press in that work be considered power. In fact it is doubtful whether a packer using steam power could be charged the additional rate, because packing is not "work" under the Tariff. The employment of a tinman using a soldering stove to close the metal linings of packing-cases would also be allowed.

Block Rates.—We now come to the last of the extra rates, those for congested areas, or, as they are commonly known, "Block Rates." Block rates were instituted in 1898, and were revised last year. They had been discussed for a considerable time before that. The idea was a favourite one of ours. We wrote in 1893:

"The question of rating by blocks instead of by buildings has been under consideration in the City some years. We have no doubt such rating is the most equitable, reasonable, and simple." The disastrous Cripplegate fire of 1897 crystallized the discussion into a Tariff notice.

The districts to which these rates apply are cross-hatched on our map. Starting at the north, we have two blocks at the corner of Goswell Road and Clerkenwell Road charged an extra 20s. This is the Charterhouse Buildings quarter, already referred to in the second part of our paper. The block surrounding Aldersgate Street Station on the underground railway is charged 5s. and 10s. South of Long Lane is the Cloth Fair and Bartholomew Close area, rated at 15s., 10s., and 5s. East of Aldersgate Street, and stretching to Golden Lane, south of Fann Street, are four blocks rated at 15s., 10s., and 7s. 6d. South of Barbican is the Jewin Street district, scene of the great fire of 1897, among others, rated at 25s., 20s., and 10s. East of this, approaching Finsbury, is the Milton Street district, the site of the City Soap Works, destroyed by fire in 1889, rated at 15s., 10s., and 7s. 6d. The parts about Wood Street, north of Gresham Street, are rated at 10s., 7s. 6d. and 5s., and include the scene of the greatest City fire of modern times, that of 1882. East of Aldermanbury the block north of the church is rated at 7s. 6d., and that to the south, surrounding the Guildhall, at 5s. The blocks south of Gresham Street and crossing Cheapside as far as Watling Street pay 5s. The fire of 1881 was at the corner of Cheapside and Bread Street, and that of 1878 in Watling Street. The narrow block facing St. Paul's Churchyard is rated at 3s. The isolated blocks to the eastward surround St. Mary Axe and Bevis Marks, already referred to as largely occupied by Oriental and fancy goods dealers. This was the scene of the fire of 1893. The block rate is 10s.

We may add that block rates are only chargeable in buildings subject to the London Manchester-Warehouse Tariff, so that you may, if you care to, rate an ironmonger at 3s. 6d. per cent., and his immediate neighbour, a London Manchester-warehouseman, at 33s. 6d. per cent.; and that, in all cases, the block rates are to be added to the normal rate, which is fixed by the cubical contents of the building, and to the rates chargeable for the special features in the risk described above.

An allowance for sprinklers in a London Manchester-warehouse can only be made after the installation has been approved by the Fire Offices Committee. The allowance for a building satisfying

the requirements of the Rules for Standard Fire-resisting Buildings is fixed at 30 per cent., but at first sight it seems very unlikely that any building not specially erected in accordance with those rules would be entitled to the allowance.

The regulations concerning the insertion of the average clause, the wording of the goods-in-trust clause, and the amount of agents' commission are scarcely within a surveyor's province, and had better be studied in the Tariff.

V. Concluding Remarks.

The changes in rating wrought by successive issues of the Tariff can best be exemplified by an actual case, the history of which we can trace in our survey books from the year 1867, when the London Manchester-Warehouses Tariff was first issued. The risk is that of an ordinary warehouse; it has remained in the same tenure, been used for the same purpose, and neither increased nor diminished in hazard from that time to this. The rate prior to 1867 was 2s. per cent. In 1870 it was 4s. In 1881 it was 3s. 6d. In 1885 it was 5s., made up of normal (under 100,000 cubic feet), 2s.; defective construction (small part of external wall weather-boarded), 1s.; windows, 6d.; wood linings, 6d.; skylight, 1s. In 1890 the rate rose to 7s. 6d., made up of normal, construction, and skylight, 4s. as before; windows, 1s., instead of 6d.; wood linings, 1s. 6d., instead of 6d.; and entirely new charges for unprotected ironwork, 6d., and unenclosed stairs, 6d. By the addition of a block rate of 5s., the premium now stands at 12s. 6d. per cent. That is to say, in thirty-five years the rate has been more than sextupled, and, so far as we know, there has been no loss under the policy.

But the business is not always of this profitable character, as another actual instance will show. The warehouse was of similar character to the last, and was originally insured in 1886. The Tariff rate was then 4s. 6d. per cent.; but, owing to the surroundings, we suggested that 10s. 6d. ought to be obtained. Owing to competition, 7s. 6d. was accepted. In 1891 the Tariff rate rose to 6s., but the rate actually received was still 7s. 6d. In 1898 the Tariff rate rose to 27s. Presuming the insurance to be still in force, the gross amount of premium received before 1898 would have been £292 10s., and since that year £351—a total of £643 10s. In 1893 and 1897 there were losses, neither by a fire which broke out in the assured warehouse, amounting together to £4152 net. Thus, if the insurance be still in force, the net losses

paid would amount to nearly seven times the gross premiums, or, taking the premiums only up to the time of the later loss, to nearly sixteen times the premiums.

A writer in the *Times*, whose letter was reprinted in the *Post Magazine* of 25th January last, states that in the Cripplegate area for the twelve years preceding, and including the year of the fire, 1897, the premiums received for fire insurances amounted to £1,050,692 and the losses paid to £1,277,989.

Of course Cripplegate is in all our black books just now, but there have been considerable fires in other London Manchester-warehouse districts. As examples where the losses have amounted to £200,000, we may mention the Watling Street fire of 1878; the Cheapside and Bread Street fire of 1881; the Wood Street fire of 1882, where the loss was a million and a half; the Milton Street fire of 1889; and the St. Mary Axe fire of 1893, where the loss was £280,000. For the purposes of comparison, the loss by the Cripplegate fire may be put at £550,000.

These were conflagrations, but a loss in a London Manchester-warehouse is seldom a trifling matter. The stock is generally so closely packed and so easily damaged that a little heat, smoke, and water play havoc with it. An expensive fabric loses its special value as soon as its colour or surface is impaired. Plain heavy goods of the best quality would fare better. The cheaper and lighter materials are frequently given substance by being treated with what warehousemen call "gum." When the material gets warm the "gum" exudes and spoils the goods. It is true that a buyer can generally be found for drapery salvage. As a rule, we do not so much object to the buyer as to the price he offers us.

Furs are very badly damaged by very little fire. A quantity of expensive furs damaged by the bursting of an electric lamp were so badly singed that nearly half of them had to be re-dressed and sold as a cheaper class of goods. Artificial flowers stiffened and put together with glue are absolutely ruined by heat and water, and suffer very badly from dirt. The same remarks apply to feathers, fancy goods, and toys. We have seen a stock of celluloid napkin-rings and similar articles, in imitation of ivory, after a fire which only reached the floor beneath that in which they were stocked. The articles were packed in cardboard boxes. The boxes only showed very slight traces of smoke; the celluloid inside was in shapeless lumps. We quote from one of our reports the following remarks referring to a fire in a carpet

warehouse:—"The carpets were almost entirely destroyed, although it was supposed they would not burn readily and that a good salvage might be looked for. The damage considerably exceeded the expectation of the Offices."

We need say little concerning the actual settlement of a loss except that, in addition to a knowledge of the goods affected, of the fluctuations in prices of raw materials and made-up stock, of discounts and profits in the particular trade, and of the prospective value of and best way to handle a salvage, the assessor must be able to grasp the system and to trace his way through the ramifications of the most complicated set of books.

Some of these attainments will also be of value to the surveyor who desires to satisfy himself about a moral risk. In the case of some of the trades rateable under the Tariff it is unfortunately impossible to take this as a foregone conclusion, and an examination of books or rough valuation of stock may have to be made.

It has been suggested to us that we should give the London Manchester-Warehouses Tariff a very good character. We are quite sure that such a Tariff is absolutely necessary to the carrying on of Fire Insurance business at a profit. The individuals who clamour so loudly for Municipal Insurance can save themselves much wind by insuring with non-Tariff Companies. Of course, it does sometimes seem hard that we surveyors find our discretion limited by the Tariff. That we must strain at a few feet of weather-boarding and swallow a glass front; that we must charge six superficial feet of skylight the same additional rate as a glass roof; the unplastered under-side of an unenclosed staircase as much as we should if all the walls, ceilings, and staircases were lined with wood; or six pipe-stoves, each having twenty feet of pipe, and a neat steam-heated, wood-enclosed drying-room no more than one pipe-stove having six feet three inches of pipe. In these respects Tariffs suffer from the defects of their qualities. Any law designed to be impartially rigid must at times approach arbitrary indiscrimination. Our business is not the making or amendment of Tariffs, but their application. The printed definitions and regulations are so abstract as to be but dull reading. Illustrated by their practical application they may prove interesting or even useful.

PHILIP F. BROOKS, F.S.I.
(HOWELL & BROOKS).

Norwich Insurance Institute,
February 17th, 1902.

WASTE PRODUCTS OF WOOLLEN AND WORSTED MILLS.

THE utilisation of the Waste Products of Woollen and Worsted Mills, although to a certain extent a new subject, is not, I fear, one which will greatly commend itself to many of you as likely to be of much interest; but the truth is, that when I yielded to a very pressing invitation from our esteemed Secretary to contribute a paper, I had a perfectly open mind with regard to the subject thereof. It was, however, intimated to me that as papers on Woollen Mills, Worsted Mills, and Woollen Warehouses had previously been read before the Society, one on the Waste products would—in the meantime, at all events—conclude the History of the Woollen Industries; and as these are undoubtedly the chief industries of our county, and therefore of the greatest importance to the Insurance men of this district, I very readily adopted the suggestion; more especially as it seemed probable that even those for whom the subject has no professional attraction might possibly find in it something of interest as opening up, to a certain extent, a passing view of a large and important industry.

During the past year—for ever memorable as the diamond jubilee of the reign of our most gracious Queen—many articles have appeared in the press with reference to the inventions, discoveries, and great changes which have taken place, and to the great improvements which have been effected, since the accession of Her Majesty, in almost every branch of the manufacturing arts, of trade, and of commerce. Sixty years ago many of these inventions and discoveries were not even dreamt of, and at that time all attempts at mechanical improvements resulted in riots and consequent disorganisation of trade; more especially was this the case in the West Riding of Yorkshire, where the Luddites for many years practically terrorised the mill owners, who lived in constant danger, not only of the destruction of their property, but of their lives. And it was not until this organised band of

rioters was suppressed, in about 1845, that it was practicable to make adequate use of the improvements in machinery for so long required in order that the supply of textile fabrics might keep pace with the ever-growing demand.

Among the discoveries of this great inventive era, the utilisation of waste of almost every description is one of the greatest triumphs, and forms a very important chapter in the Commercial History of the period; and in that chapter few items surpass in interest the History of the Waste from the Woollen Industries.

In 1838—and indeed at a much later period—practically all Woollen Waste was thrown away as valueless, but at the present day almost every atom is made to serve some useful purpose; and I propose to introduce to you this evening the most important of the different works in which this waste is converted into various materials of commercial utility. When entering on this wide field, however, I must confess that I feel like one who looks on some vast exhibition and knows not where to commence his survey; but in order to make my summary—for it cannot be more—as practical and complete as possible, I propose, before commencing our imaginary tour of inspection among these works, to briefly recapitulate the principal processes in Woollen and Worsted Mills, in order that we may set out with a clear understanding as to the nature of the wastes and the manner in which they are produced. First of all, however, it is advisable that we should thoroughly understand that the great value of wool for all manufacturing purposes is dependent on a peculiarity in the structure of the fibre, which, though largely of a microscopic character, I will endeavour to briefly explain. The woollen fibre or hair, which is regularly curved and somewhat elastic, is of cylindrical shape, the surface being coated with imbricated or overlapping scales (varying from 1,500 to 3,000 on an inch of fibre) arranged somewhat similarly to those of a fish and pointing from the root to the tip of the hair. These scales or protrusions are attached to the hair merely by their roots; and by pulling a lock—that is a number of fibres—or even a single fibre, gently between the forefinger and thumb, it is comparatively easy, with most classes of wool, to discover whether a given end is the root or the tip: as passing from root to tip the hair feels perfectly smooth, but if reversed a distinctly rough or harsh feeling is observable.

It is to this peculiarity in the mechanical structure of the fibre

that the Milling or Felting property of wool is primarily due, as it will mat or felt when heat, moisture, and pressure are applied; and the felting power is consequently highest, as a rule, in the wools containing the largest number of imbrications.

In some parts of the world, even at the present day, the fact that woollen fibres have the capability of interlocking without being twisted is taken advantage of in the manufacture of clothing by the elementary process of damping a layer of wool and then beating it with some flat wooden implement—in all probability this method was one of the earliest applications of wool.

Now, what I wish to *particularly* impress upon you with regard to the construction of woollen fibre is, that no amount of wear can altogether destroy its scaly structure, and that after it has been woven it can be again reduced to the condition of wool, still retaining in a very large measure its original structure, and therefore can be re-manufactured into a new material.

Of Wools there are innumerable varieties, which are constantly being added to, but they are all roughly divisible into two great divisions or classes—first, short staple or short fibre wools, usually of fine quality, and which are manufactured into clothing and other woollen goods; second, long staple wools, which are generally coarser in quality, and are manufactured into Fabrics termed "Worsteds," such as stuff goods. The Woollen Industries themselves are likewise separated into two great divisions, chiefly dependent on the method of manipulation, which in turn is largely governed by the foregoing classification of wool; these two divisions, I need hardly say, are the Woollen trade and the Worsted trade, each of which is sub-divisible into several branches, but for our purpose this evening it is only necessary that we should consider a fairly representative type of mill in each class.

The excellent papers on Woollen and Worsted Mills which have been read to the members of this Institute give a full description of the processes carried on; in the following references to the wastes produced in these mills, therefore, I assume a knowledge of the processes, but in order to refresh our memories on the subject, I propose to show you illustrations of the various machines referred to.

WOOLLEN MILLS.

In a series of processes so varied as those adopted in the manufacture of woollen cloth, it is obvious that there must be a large amount of waste of different kinds. Taking these processes in their order, we have the preliminary ones of Sorting, Washing, Drying, and Burring; but I will refer to these under the heading of Worsted Mills, and commence with the first process in oiled wool by machinery, viz. :—

Willeying. There are two kinds of machine used in this operation. First, a Shake Willey (Fig. 1),* having for its object the disentangling of the matted fibres and the removal of dust, dirt, and other impurities. The light dust is drawn away by a fan at the back of the machine, and the heavier matter falls through a wire grid at the bottom. As a rule it is of little value, and if not burnt is sold either for manure or to the oil expresser.

The second machine is the Tenter Hook Willey (Fig. 2), also known locally as a "Fearnought," "Dule," or "Devil," which is used for perfecting the opening process commenced in the Shake Willey, in order to facilitate the work of the carders. Only a small quantity of waste of no practical value is made.

Scribbling, Carding, and Condensing— (Figs. 3, 4, and 5.) as a matter of fact all one process—are the next operations, and complete the preparatory treatment the material has undergone in the Willeys. From this set of machines three descriptions of waste are obtained. First, the sweepings or droppings which fall on to the floor under the machines—chiefly under the "Scribbler"—and are commonly known as "Fud," and in the Huddersfield district as "Shoddy" —a misleading name which under the old Woollen Mill Tariffs not infrequently led the unwary surveyor into difficulties. Second, the short fibres which become fixed between the teeth of the cards and are combed out by hand. These are known as "Combings" or "Fettlings." And third, the "Fly," which is the short fibre thrown off by the cylinders of the machine when in motion.

* Figures 1 to 6 are shown in Paper on "Woollen Mills" by J. B. Roberts (*Federation Journal*, Vol. I.).

With regard to the subsequent utilisation of these wastes, it is impossible to speak with certainty. In some mills, all are cleaned and used again in a lower blend; in others, only the "Fettlings" are used, and the "Fud" and "Fly" sold; sometimes all three classes are sold to the waste merchant or the oil expresser, and occasionally all three are burnt.

Spinning. (Fig 6.)

The waste from this process consists of a variable quantity of "Fly" and of the unused ends from the Condenser Bobbins, and the fragments of yarn pulled off by the attendant or "Mule-tenter" when joining together the ends of a thread which has broken owing to irregularity in the thickness, to the accidental introduction of any hard substance, or to some other imperfection. This waste is almost invariably used again by the manufacturer, as it is very soft and easily re-carded.

In Twisting and subsequent Processes up to and inclusive of Weaving.

the waste made consists of short lengths of hard threads which require to be opened or "garnetted" before they are of further use to the woollen manufacturer. In the manufacture of blankets and other goods, where the object is to produce a yarn as soft and open as possible, all these thread wastes are readily re-carded without undergoing the garnetting process. There is also a certain amount of "Fly" in these factories.

After the cloth has been woven, any defects therein are repaired, and all knots, burrs, and other impurities removed; these operations being known as Mending, Knotting, and Burling. The cloth is then washed in order to cleanse it from dirt, oil, and size, and taken to the Fulling Stocks or Milling Machine (Fig. 7), where it is fulled or milled. During this process a considerable quantity of fibre is loosened, some of which is found under the rollers at the back of the machines, but the major portion is washed off in the succeeding operation of Scouring, and as these fibres are of considerable value they are recovered—by draining off the water—and form the first of the well-known Flock tribe, their specific name being "Milling Flocks."

After passing through the Hydro-Extractor and Tentering Machine, the cloth undergoes several finishing processes, which vary according to the material operated and the class of goods to

be produced. Raising, Cutting, Brushing, Steaming, Pressing, etc., are the chief of these, but the only ones I need specially refer to are Raising and Cutting.

The chief feature of the Raising Gig (Fig. 8) is a revolving wooden cylinder containing sixteen oblong spaces for the reception of frames into which teazels are inserted, and by means of these teazels the surface fibres of the wool are raised upon the

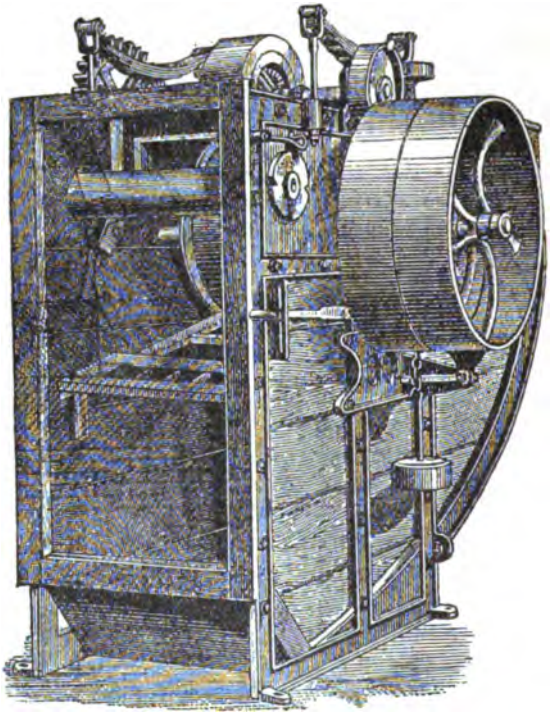


Fig. 7.—Milling Machine.

face of the cloth, which is generally in a wet state (*i.e.*, the process usually follows scouring). The teazel, I may mention, is the ripe burr or head of a thistle-like plant specially cultivated for this purpose. It is cone-shaped and covered by a great number of hooked points; these all curve downwards and are very strong but slightly elastic, hence their great value for cloth raising. After being used for some time, the teazel hooks become filled with short fibres, which are removed by hand. These fibres are Raising Flocks.

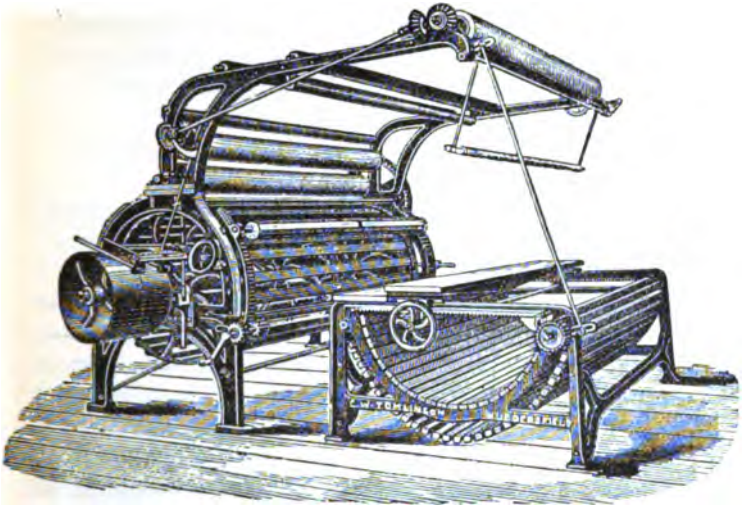


Fig. 8.—Raising Gig.

In a Cutting or Shearing Machine (Fig. 9), the raised nap is shorn short and smooth by a revolving spiral knife working in close proximity to a straight blade. The short fibres thus removed are another species of flocks, viz., Cutting Flocks.

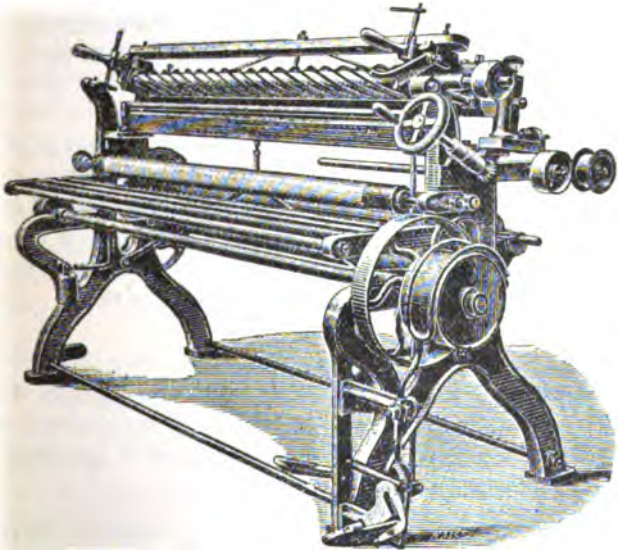


Fig. 9.—Cutting or Shearing Machine.

I have now very briefly enumerated the chief of the Woollen Mill processes in which waste is formed, and must in an equally cursory manner review the second of the great woollen textile industries, viz.—

WORSTED MILLS.

Sorting. The first operation in which a certain amount of waste is produced is that of *Sorting*. As the fleece is being divided into various qualities, twigs, straws, and other impurities are picked out; to these some loose fibre adheres and is known as "Pickings." Hard tufts of coarse and matted hair are also clipped off, and these are "Shearlings." This waste is readily purchased by waste merchants.

Shaking. The next process for certain kinds of wool is *Shaking*, in order to remove dirt and other impurities adhering to the wool in such small fragments as not to warrant attention from the sorter. This waste consists chiefly of dung, lime, etc., and is valued by farmers as an excellent manure

Washing. The wool, you will no doubt remember, is next washed (Fig. 10),* and here the principal waste fibre is from the squeezing rollers, which are provided with a covering or padding of long stapled wool. This gradually wears out (especially where much skin wool is used, owing to the action on the padding of the lime used in removing the wool from the skins), and when removed from the rollers is known as "Washing Roller Laps," being a portion of the somewhat large family of Lap Waste which has recently so exercised our minds in connection with the Woollen Warehouses Tariff. From the suds in these machines the fatty matter contained in the wool and in the soap is also recovered, as I shall describe later on.

Burring. In Burring—that is, removing the burrs by cutting or crushing—a certain quantity of fibre adheres to these burrs, and this is subsequently removed by a process similar to the one adopted in the extraction of cotton from woollen rags.

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* Figs. 10 to 20 are shown in Paper on "Worsted Mills" by J. Cooper Eddison (*Federation Journal*, Vol. IV.).

Drying. In Drying there is practically no waste.

Carding. In Carding (Fig. 11) the waste consists of "Fly," of the "Droppings" under the machine, and the "Fettlings" from the cards. In many cases these may be again divided into two classes, *i.e.*, dirty Droppings or Fettlings from the front portion of the carders, that is the "Lickers-in," and clean Droppings or Fettlings from the rear portion. Both the clean varieties of these wastes are frequently used again in the same mill for a lower grade of manufacture than that in which they were produced. If not so used they are sold, together with the dirty waste and "Fly," to a waste merchant, by whom they are cleaned and sorted, and disposed of to manufacturers of blankets and other goods of a similar character, or for felting purposes.

Preparing. In Preparing (Fig. 12), to straighten and separate the fibres preparatory to Combing, a certain amount of fibre is closely imbedded in the gill-pins of the "fallers" (steel combs), and when removed is known as "Faller Waste." As it is very hard and tough it is sold to the waste merchant or opener. There is also occasionally a small quantity of broken Sliver, but this is invariably used again by the manufacturer.

Back-Washing. In Back-Washing (Fig. 13) the wool is cleansed from the oil added to facilitate the carding process, and this is subsequently recovered along with the grease from the Washing Machine suds. The squeezing rollers also in this machine are covered with paddings of woollen fibre similar to that on the Washing Machine rollers, and when worn out are also "Washing Roller Laps."

Combing There are several varieties of Combing Machines, but the Noble's or Circular Comb (Fig. 14) is the one with which we are probably most familiar. It is on the Combing Machine that the best known of all the worsted wastes, viz., "Noils," are produced; these, as you are all aware, are simply the short fibres combed out of the longer ones.

In the Lister or "Nip" Comb (Fig. 15), in addition to the Noils there is "Faller Waste" from the Screw Gill-Box, which forms the front portion of the machine.

Gilling. In the Gilling processes, which complete the formation of the sliver into a "Top" or "Ball," the waste is of a similar character to that in the Preparers or Screw Gill-Boxes.

Drawing and Roving. In the somewhat lengthy processes of Drawing and Roving—for reducing the thickness of the sliver — (Figs. 16 and 17), which are usually the first ones in a Worsted Spinning Mill, the principal waste is "Laps"—that is, the material which wraps or laps round the rollers in the event of an accidental breakage of the Slubbing or Roving. If these laps are formed in the earlier stages of the drawing process (*i.e.*, when thick counts are being drawn) they are used over again; but if later, or on the Roving Frame, they are another addition to the Lap family previously referred to. There is also a certain amount of "Brush Waste" and a small quantity of waste formed when two ends of sliver are carelessly joined together, leaving a lump or protrusion, which is picked off by the girl attending to the machine. This is known as a "Drawing Lump," and, as the girls are frequently paid a small sum for this waste, they look after the lumps very carefully.

Spinning. There are three systems of Worsted Spinning —"Flyer," "Ring," and "Cap." On a "Flyer" Spinning Frame (Fig. 18) three distinct classes of waste are made. If a thread breaks before it reaches the top of the spindle, it wraps round one of the front rollers—usually the top one—and this again is a "Lap." If, however, the thread breaks lower down, it wraps round the "flyer," and this is "Snarl" or Spinning Waste. The third variety is "Fly" or Brush Waste, which only occurs in considerable quantities when low foreign or coarse wools are being spun.

In Ring Spinning (Fig. 19) the waste is similar, excepting that, as there is no "flyer," the corresponding hard waste is found twisted round the top of the bobbin.

In Cap Spinning (Fig. 20) there is no *hard* waste unless two adjoining threads break and become entangled together.

In Twisting and subsequent Processes

the waste is merely short pieces of broken thread, except that in weaving there is "Fly" waste and an additional waste known as "Thrums"—which are the threads and short length of the piece cut away from the beam when it is removed from the loom. All these wastes go to the waste merchant or waste opener, where we shall meet them again. The thread wastes are also very frequently used in the mills for cleaning purposes.

Before leaving this portion of my subject, it may perhaps not be out of place to mention that in a worsted waste merchant's warehouse will be found varieties of almost every kind of waste produced in these mills, ranging from uncleaned Card Waste at twopence to Botany Noils at sixteenpence per pound, and occasionally Laps and Noils at even much higher prices—Cashmere Noils, for instance, at three shillings and sixpence. You will observe, therefore, that many of these wastes are much more valuable than wool itself; and cases have been known where the "Drawing Laps" have sold for more money per pound than the "Tops" from the same material. There is just one other point in connection with these waste warehouses which is worthy of mention, and it is this—that at the present day they are, as a rule, much better risks than they were many years ago, for the reason that the manufacturers themselves not only classify the waste in a great measure, but also keep it as clean and dry as possible; whereas formerly it was held as being of little account and was therefore kept anyhow and anywhere, with the result that when it reached the merchant it was not only dirty but very frequently wet, and consequently exceedingly liable to spontaneous combustion.

WASTE PRODUCTS.

You will have gathered from the foregoing brief descriptions that a very large proportion of the wastes made in Woollen and Worsted Mills are again used by the manufacturer, for it is to his advantage to utilise them so far as it may be true economy to do so; or, if not so used, it is disposed of to a waste merchant, who, after cleaning and sorting operations, sells it to a manufacturer engaged in a probably lower class of trade than the one from which the waste was originally obtained. As previously

explained, however, no general rule can be laid down as to the exact course adopted, for the reason that even manufacturers engaged in precisely the same class of trade and using identical materials will adopt different customs with reference to the utilisation and disposal of their wastes. Roughly speaking, however, the clean or readily cleaned soft wastes (*i.e.*, those made in spinning and previous processes) are used again by the producer, and the dirty waste and the hard wastes are sold to the waste merchants; but, in addition to all these, there are the wastes utilised for other purposes, and which may be divided into two main classes:—

First—The waste made when the material is passing through a process of manufacture: not merely waste of the raw woollen fibre, but of the materials used to facilitate the manipulation thereof.

Second—All cast-off wearing apparel and other woollen goods no longer suitable for the purpose for which they were originally used.

In the first of these classes we may place

The wool and cloth scourings and the low greasy waste from which oil is recovered.

The hard twisted thread waste which is opened to produce material known as pulled yarn.

The flocks from the finishing machines.

The second class is composed of rags of all descriptions, and from which Mungo, Shoddy, Extract Wool, and Ground Flocks are made.

Rags are also largely used for the manufacture of Cloth Hearth Rugs.

RECOVERED OILS.

As some of these oils are recovered from one of the preliminary woollen processes by machinery, viz., wool washing, it is perhaps best that I should refer to them before the waste products recovered from later processes, in order to preserve a proper sequence so far as possible.

I have for convenience sub-divided the Recovered Oils into three classes, although, as a matter of fact, the second class is usually combined with the first or third in the majority of oil works engaged in this trade.

Class I. Distilled Oleins and Wool Oils obtained from the Wool-washing Suds.

Class II. Cloth Oils and Black Oils recovered from Cloth Scourings.

Class III. Black Oils expressed from Greasy Waste.

Class I. The grease from which the oils of this class are produced is obtained chiefly from Wool Combing Works and Worsted Mills in which wool scouring is done, and it is at these mills where the first portion of the recovering process is carried on. The suds from the wash bowls are collected in large tanks and treated with sulphuric acid (vitriol); this causes the material to crack—that is to say, the grease or fatty matter held in solution is set free and rises to the top. The waste water is then run off, leaving as a residue this greasy matter, which is either wool fat (the natural grease contained in sheep's wool) mixed with the fat or oil contained in the scouring soap, or, as is more commonly the case, it is a mixture of these fats with the oil used by the wool comber or worsted manufacturer. After the water has been drawn off, the greasy residue is pumped into shallow pans, allowed to solidify, cut into small blocks, wrapped in bags, and placed in a steam press; the oil is then squeezed out and again allowed to solidify. In this state it is known as Yorkshire or Brown Grease, and at this stage of its existence is packed in barrels and sent off to the premises of the oil manufacturer. Before following it there, however, I will read you an extract from the valuable work "Oils, Fats, and Waxes" (Benedikt and Lewkowitsch) with regard to the constituents of "Yorkshire Grease," which it states consists essentially of three groups of fatty substances.

"1. *Free Fatty Acids*, resulting partly from the decomposition "of waste soap and partly occurring naturally in wool fat.

"2. *Neutral, saponifiable ethers.* These consist in the first "instance of the characteristic saponifiable constituents of wool "fat, the chemical constitution of which assigns to them a place "amongst waxes. In admixture with this neutral substance "there may be present Glycerides, *i.e.* true neutral fats owing "their presence to fatty oils used in oiling the wool fibre. If no "glycerol has been found in the recovered grease, the neutral "portion is, of course, simply a mixture of waxes.

"3. *Unsaponifiable matter* consisting of alcohols such as Ceryl

"Alcohol, Cholesterol, &c., naturally contained in wool grease; any "hydrocarbons that have found their way into the oils used for "lubricating the wool will be met with in this portion of the "grease."

The Greasy Cake ("Seak Cake") left in the press cloths after the oil has been expressed is usually sold as a manure, but as it contains about 15 or 20 per cent. of oil, some firms dry this unpromising-looking substance and grind it in a disintegrator. It is then placed in a strong iron cylinder or "operator," the lid of which is tightly clamped on and bisulphide of carbon pumped in. This volatile liquid extracts the oil, and the solution rises to the top of the cylinder, from whence it is pumped into a steam-heated still; here the bisulphide rises to the top and is drawn off into tanks, where it is kept under water; the oil is run off from the lower portion of the still, and subsequently clarified and purified by steam injections. This is an exceedingly hazardous process, owing to the storage and use of bisulphide of carbon, the danger of which can scarcely be over-estimated.

We now come to the oil manufacturer's premises, where the first operation is to melt or liquefy the grease in the barrel by blowing steam therein. It is then run into an iron tank, and here, if the original grease has an offensive smell—as it frequently has—it is clarified and purified by further injections of steam, and subsequently gently boiled in a pan fitted with a steam coil at a temperature not exceeding 200 degs. Fahrenheit, this being done in order to prepare it to a certain extent for the stills, also to free it from water formed by steam used in the previous processes, and thus minimise the danger of a boil-over in the stills into which the oil is next pumped.

Of oil stills there are several varieties, and as many of them are patents I am not able to show you a diagram; most of you, however, will know what they are, but to those who do not, I may explain that they are large cast-iron vessels set in brickwork, either over or at one side of a furnace. In neither case, however, do the flames play directly on the still, but the products of combustion from the furnaces are carried under or round the lower portion of the still on their way to the chimney, and a considerable amount of heat is thus derived; the principal application of heat, however, is by means of steam which has been superheated in a hot-air chamber over the furnace. The pipe which admits the oil enters at the top of the still, and the gases and vapours formed by

the volatilisation of the oil are carried away by a trunk or large pipe at the head of the still, to at least two series of condensers; there is also a pipe at the bottom for removing the residue, or "Pitch."

The first portion of the distillate, though it may only occur in small quantities, is usually a very volatile oil (consisting largely of hydro-carbons) known as oil spirit, which in consequence of its low flash-point is only used as a solvent in the manufacture of paints and varnishes; the second and chief portion of the distillate consists of a light brown oil, and the third portion of a dark brown oil which is re-distilled; the residue in the stills being a species of pitch which is largely used as a lubricant for the necks of steel rollers in engineering shops and also for insulating purposes in electrical work.

The second or chief portion of the distillate is run into tubs, where it is allowed to cool and solidify. It is then wrapped in cloths and placed in a powerful steam press, where it is separated into Oleine or Brown Wool Oil, and Stearine, which is the hard substance remaining in the cloths, and which when removed is sold either to soap or candle manufacturers as an inferior material for use in these industries, or to curriers for the manufacture of dubbin. If the Oleine or Wool Oil obtained is not of a sufficiently good quality to satisfy the requirements of the manufacturer, it is re-distilled, by means of which a further quantity of pitch will be extracted, and the flash-point and saponifiable percentage of the oil thus raised.

These distilled Oleins or Wool Oils, when commercially analysed, will be found to contain a variable percentage of unsaponifiable matter; but it must be borne in mind that this is not necessarily mineral oil; in fact, in the class of oil under consideration there is rarely any admixture of mineral—not when it leaves the still at all events!!—the unsaponifiable matter consisting of hydro-carbons partly yielded by the distillation of the neutral ethers referred to, but chiefly from the cholesterol contained in the yelk or natural wool grease to the extent of nearly 40 per cent. Now, although the chemist can discriminate the cholesterins from mineral oil, he is, I believe, practically unable to distinguish between the hydro-carbons into which they are formed by distillation, and the hydro-carbons constituting mineral oil. In a great measure, however, this inability to distinguish between the two is immaterial, for, as regards flash-point at all events, they are apparently equally dangerous.

I may mention that pure wool grease, when purified by various patent processes, is now also used by chemists for the production of Lanoline, a substance which is largely used in the preparation of salves and ointment, as it is easily absorbed by the skin, readily combines with water without losing its salve-like consistency, and does not turn rancid.

Class II. Cloth Oils and Black Oil recovered from Cloth Scourings.

In order to remove the oil from woollen pieces before dyeing or finishing, they are usually treated with soap or alkali in water. This causes the oil to partially saponify and partially emulsify, and the solution, known as "Seak Liquor," is run off into tanks, where it is treated with sulphuric acid; the alkali in the solution is thereby neutralised and the oil set free. This rises to the top as a fatty matter known as "Fullers' Grease," but locally the terms more frequently applied are those of "Magma" or "Seak." The waste water is run off and the "Seak" wrapped in bags or cloths, then placed in a steam press and the oil extracted. The dirt and fibrous matter remain in the bags and are sold as manure for the hop gardens of Kent. The oil thus obtained is subsequently refined by distillation, and according to its original constituents is manufactured into a Brown Cloth Oil or a Black or Recovered Oil. It will, of course, be readily understood that these oils will vary greatly, as their quality is almost entirely dependent on the oil which has been used by the cloth manufacturer.

At some mills the scouring liquor, instead of being utilised for the recovery of the oil contained therein, is run on to the land, as it possessses excellent manurial properties, more especially if the land is sufficiently sandy to allow the water to readily drain away.

Class III. Black Oil expressed from Greasy Waste.

You will remember that in describing the woollen mill processes, I told you that all dirty greasy waste which could not readily be utilised for any other purpose was usually disposed of to the manufacturers of Black Oil. This Waste is chiefly obtained from the Woollen Willeying and Carding Machines, and when received by the oil manufacturer merely undergoes a mechanical process. It is placed in a cylinder heated by steam, under a powerful hydraulic press (Fig. 21), and

the excess of oil on the waste squeezed out, and clarified by injections of steam and subsequent filtration. The composition of this oil will practically be identical with that of the oil used on the material from which it is recovered.

The Waste, after the oil has been expressed therefrom, is sold largely to the hop growers for manuring purposes. It is also occasionally found in bone manure works, where it is chiefly used to lighten the ground bones and phosphates. Flock merchants also use this waste in the preparation of low blends of flocks.

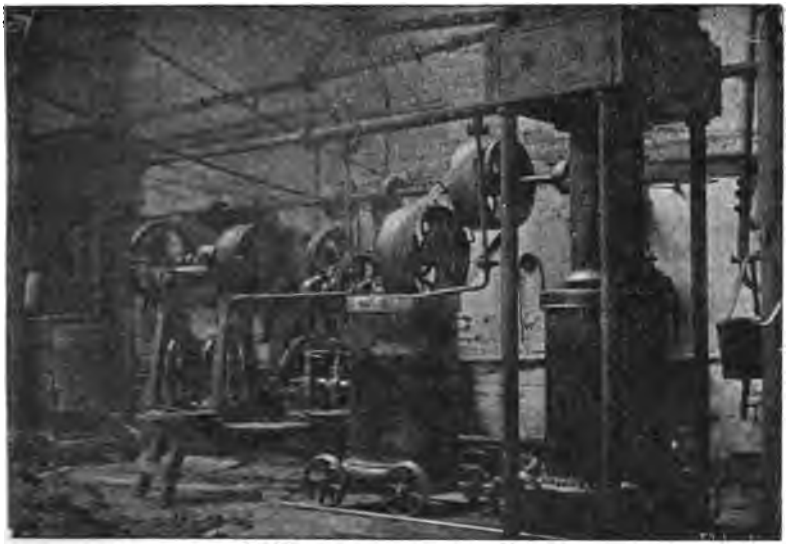


Fig. 21.—Waste Presses.

Owing to the alteration of the Woollen Mill Tariff in 1892, I believe that a very marked improvement has taken place in the character of Recovered Oils. At all events, more than one firm of extractors have assured me that the oils test from five to ten per cent. better as regards saponifiable matter than they did six years ago; and this is undoubtedly a matter for congratulation by the Insurance Companies, as it proves that their efforts to minimise the use of mineral oil for blending purposes have not been altogether in vain.

Among the special features of fire-risk in this class of works, I would particularly draw your attention to—

The Stills. These should be placed either in the open yard, or in a detached building of lofty construction and having a fireproof roof. When the Stills are placed directly over the furnace they are much more hazardous than those fixed at some distance to the side thereof, as in the event of a boil-over, despite many ingenious contrivances in the shape of safety valves and overflow pipes, the boiling liquid appears to invariably find its way to the furnace, with dire results—as witness two heavy fires during the past year from this cause at some Bradford works.

A good heap of sand or crushed ashes should always be kept in the still-house.

Oil Tanks should not be placed in the open yard, as they are particularly liable to damage by lightning.

Waste Heaps should be kept quite detached, as spontaneous combustion of the waste is by no means uncommon.

Sawdust, if used as an absorbent for leakages, should be regularly removed, as it is also addicted to heating.

Ventilation of the buildings in an efficient manner is desirable in order that fumes and vapours may be carried off.

WASTE OPENING OR GARNETTING.

Woollen and Worsted Yarn or Thread Waste which has been too hard twisted to admit of its being recarded by the manufacturer is usually disposed of or sent on commission to "Waste Openers"; the exception being the large woollen factories, where it is advantageous to open this waste on the premises.

The waste opener—the man, not the machine—is not infrequently a rag grinder as well, but for the purpose of this Paper we will consider him on his own merits. The material he operates on does not necessarily consist of hard threads only, as for the export and felting trades large quantities of soft spinning waste and card waste are also opened, and very beautiful looking material it is after it has been washed and dried.

Fig. 22 is a Garnett or Waste-Opening Machine. It may comprise one, two, or three swifts. The illustration shows a two-swift machine, very similar in appearance, you will observe, to a carder, and, as I will endeavour to explain by means of a skeleton diagram (Fig. 23), there is also a great similarity in its action—the chief difference being that the machine is constructed entirely of iron, and the rollers and cylinders, instead of being clad with cards, are covered with sharp saw-like steel wire fixed in circular grooves. So fine is this wire made that there are sometimes as many as twenty-four rows to the inch.

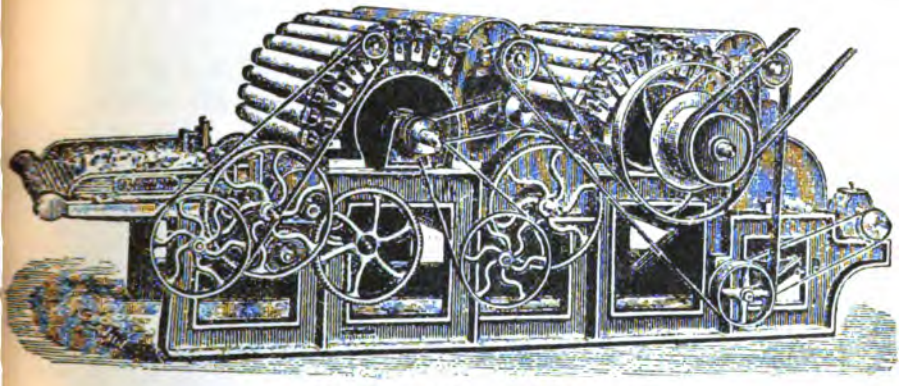


Fig. 22.—Garnett Machine.

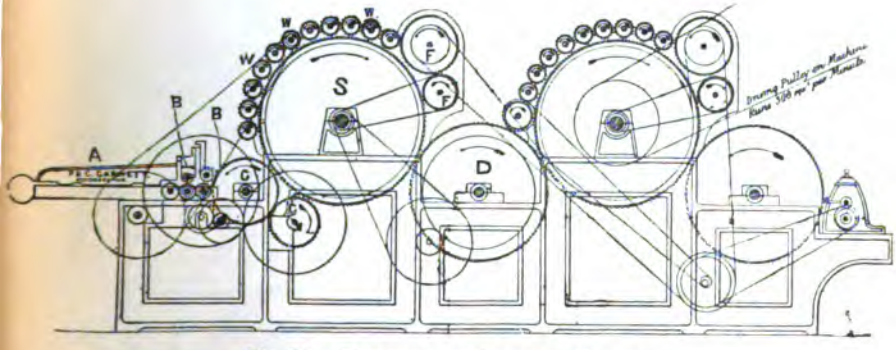


Fig. 23.—Skeleton of Garnett Machine.

"A" is a latticed feed apron.

"B B" are the feed rollers—the first pair being fluted, and the second pair covered with coarse garnett wire. Under these is a spiral brush to prevent the material dropping down.

"C C" are the "Lickers-in," which receive the waste in a compressed state from the feed rollers and pass it on to the first swift ("S"). The series of small rollers above the swift and marked "W" are the workers, which, as in a carding machine, revolve more slowly than the swift, and receive therefrom a continuous deposit of material, which is passed along until it reaches the fancies ("F"), which revolve very quickly and raise the material on the swift in order that it may be readily removed by the doffer ("D"), whence it is taken by a small roller called a stripper and delivered to the second swift. There the same process is repeated until the material reaches the second doffer, from which it is removed by the doffing comb in a sliver of beautiful soft fleecy fibre.

Fig. 24 is the skeleton of a Garnett Knot Breaker or Preparer, which is used for opening "thrums" and knotted waste. It is not unlike a small opener, but the wire is much coarser and more openly set, there being not more than five or six rows of wire to the inch.

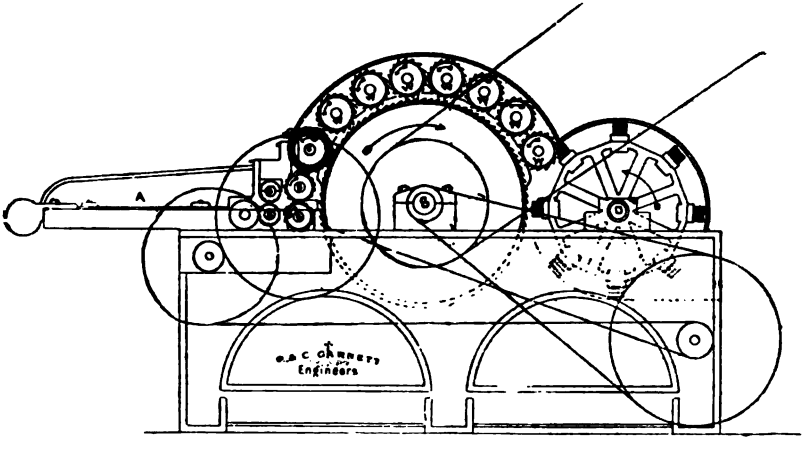


Fig. 24.—Skeleton of Garnett Knot Breaker.

"A" is the invariable latticed feed.

"B B" are the feed rollers, fluted and wired as in the opener.

"C" is a brush to press the material firmly into the swift ("S") and to prevent it falling therefrom during its passage from the feed rollers to the workers ("W"), which operate precisely the same as in the Garnett; but the material, instead of being removed by a "fancy" and "doffer," is swept off by the large revolving brush ("D").

If it be necessary to clean the material before it is opened, some form of Waste Shaker is used, the one shown in Fig. 25 being specially manufactured for this trade. It consists of a strong iron frame containing two revolving wooden rollers studded with iron spikes or teeth, which not only remove dirt, but to a certain extent prepare the waste for the opener.

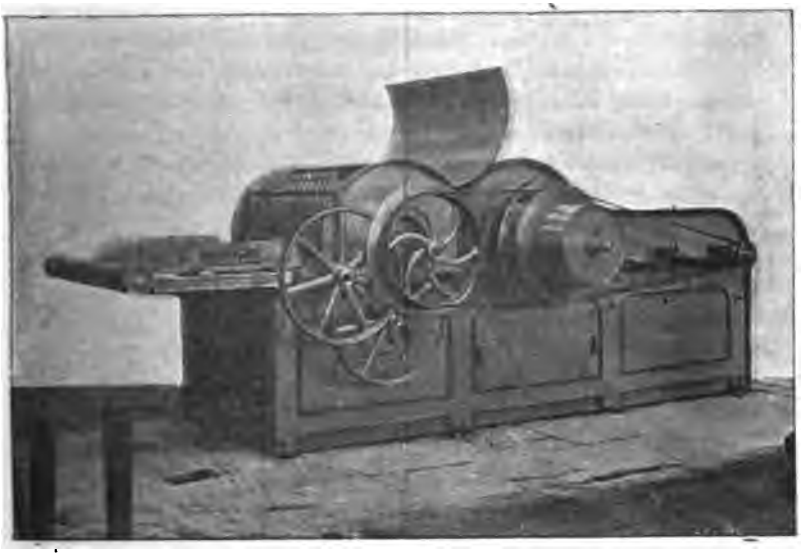


Fig. 25.—Garnett Waste Shaker.

Garnetted material is largely used by woollen manufacturers, both in this country and on the Continent; it is also used extensively in the felt cloth and hat trades, and as a stuffing material by upholsterers and saddlers. I believe that pulled carpet yarn is chiefly used in the last-mentioned trade; and it is

customary, when opening this yarn, to have a small condenser attached to the Garnett, in order that the material may be delivered in rolls or laps, which are more easily manipulated by the saddler.

The fire-hazard of garnetting is very similar to that of carding, when the machines are used by woollen manufacturers for pulling their own waste, or bought waste if free from cotton. Waste-opening works in which the material operated upon is pure woollen are also comparatively unobjectionable risks; but when yarn is pulled on commission, or waste dealing of a low class is carried on, the risk of fire is very materially increased. For instance, Angola, hosiery yarn, and others frequently contain cotton in large proportions—70 or 80 per cent. is not uncommon; and I need hardly tell you that whenever you have cotton you have an increase of risk. Then, again, in many of these works certain classes of waste are kept which are hazardous in the highest degree owing to their greasy condition and consequent liability to spontaneous combustion. Card Waste from the heavy woollen district and also from the Scotch tweed mills is particularly objectionable, and I remember a risk of this class which some years ago was twice "gutted" within twelve months. And yet, apparently, some Offices consider buildings stored with such material are desirable risks, as a case was brought to my notice the other day which had been reluctantly accepted some years ago at 21s., now transferred to another Office at 7s. 6d. per cent., because that is the Tariff rate!

It is practically impossible for the Tariff authorities to provide a rate for each of the many varieties of woollen waste warehouses, and 7s. 6d. is the minimum rate presumably applicable to buildings used for the storage of mungo, shoddy, and thread waste. To charge the same rate for a greasy-waste warehouse is an absurdity even greater than the rating and classification of mixed rag stores with woollen rag warehouses, which so recently resulted in serious misapprehension by the Tariff Offices, and consequent loss of business to them.

FLOCKS.

The somewhat numerous family of Flocks is divided into two separate and distinct classes, viz., Ground Flocks—that is, material ground from rags—and Finishers' Flocks—*i.e.*, the soft fibrous

material from cloth-finishing processes; and, as the latter are of better quality than the former, I propose to give them pride of place and consider them first.

Finishers' Flocks. These are obtained chiefly from the Milling Machines or Fulling Stocks, the Raising Gigs, and the Cutting or Shearing Machines. There are also a few from the Brushing Mills, and a small quantity known as "Swimmers" from the Dye Vats; but in woollen works of even considerable extent the two latter kinds would probably not fill two bags in the course of a year. Then, in addition to the above, when very low blends of flocks are being prepared, a percentage of dry mill waste is used—this waste being the material from which the oil has been expressed in the third class of recovered oil-works previously described to you.

When the flocks are received by the manufacturer they are, unless exceptionally free from dirt and other impurities, passed through a "Whimsey," of which there are several varieties. In its simplest form it is a horizontal wire reel, rather like an enlarged squirrel cage, set at an angle of about 15 degrees. This reel revolves very slowly and allows the dirt to fall through the wires into a dust trunk or some other receptacle below the machine; the flocks, which are fed into the higher end of the reel, gradually pass out at the lower one. An improved form of Whimsey is one having wooden beaters (making about 100 revolutions a minute) within the machine, thus more effectually cleansing the flocks from dirt, which drops through the wires into a wooden trunk; but as some portion of the material is also knocked through by the beaters, all matter in the trunk is conveyed by a worm to the top end of the reel, where the dirt is separated from the fibre by a sieve, and the latter again passed through the machine.

After this cleaning process the flocks are taken to the Curling Machine (Fig. 26), which in appearance is very similar to a Shake Willey. It merely consists, however, of a large hollow cylinder about three feet in diameter, which was at one time constructed of wood; but, as greater speed is now required, the modern cylinder is of wrought iron, studded with large steel teeth. Enclosing the cylinder is an iron casing with an opening at one end, through which the flocks are passed by an endless band into the machine. Here they are caught by the teeth of the rapidly

revolving cylinder (about 700 per minute), condensed or curled, and then driven through a wire grating, forming one side of the cover, into another Whimsey, which removes any dirt still adhering to the flocks. At the opposite side of the Curler there is a mesh of fine wire gauze, through which the dust is drawn, by a fan fixed at the top of the machine, into a trunk, and then to the dust

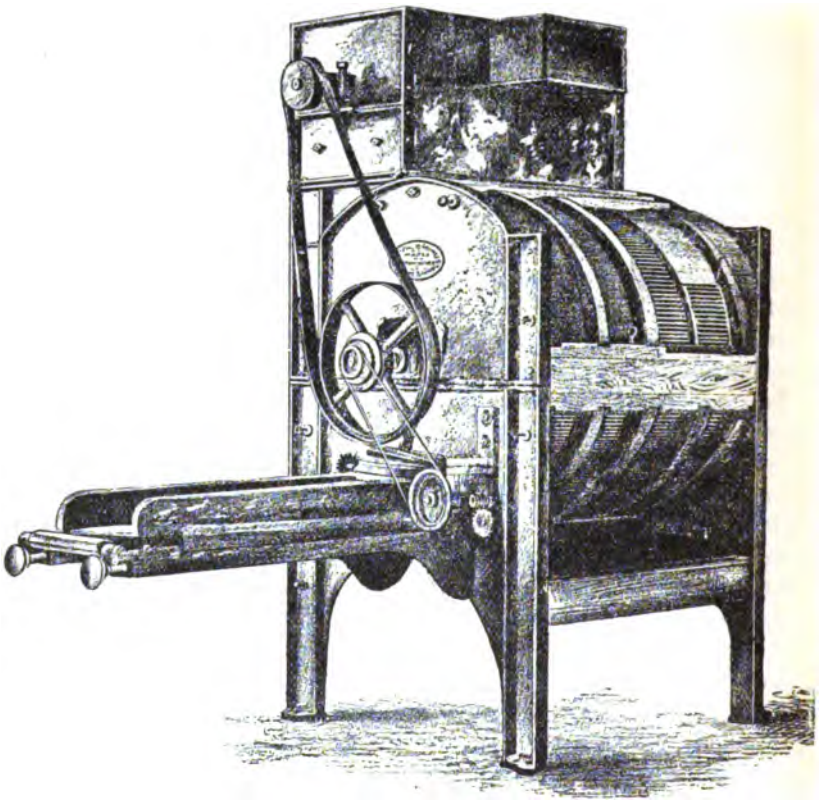


Fig. 26.—Flock Curling Machine.

chamber; every precaution is therefore taken to ensure the flocks being thoroughly cleaned.

I have always been somewhat mystified as to the reason of the curl imparted to the flocks in this machine, and have made several enquiries on the subject, with the result that the most

probable solution appears to be that of centrifugal force. It has been calculated that a wheel three feet in diameter, making 700 revolutions a minute, would by centrifugal force increase a pound weight, attached thereto, to about 250 pounds. By this same force it would appear that the flocks in the Curling Machine are, for the time being, increased so enormously in weight that they become condensed into a small egg-shaped mass or "curl," in which form they eventually emerge from the machine; and I may mention that this theory is strengthened by the fact that the greater the speed of the cylinder, the smaller do the curls become.

The flocks prepared at the class of works under consideration are used chiefly for beds and upholstery, but some of the better classes of Milling Flocks are also used by spinners of yarn for the Leicester and Scotch hosiery trades, as a substitute for wool or mungo; the material being much cheaper than the former and considerably lighter than the latter.

The dirty waste from the flock-cleaning processes is used as a manure in the hop gardens of Kent, and also as an absorbent in stables.

Flocks from the Cropping Machines in rug factories, and also some Cutting Flocks, are used in the felt hat trade, and some in the production of certain classes of wall-paper for decorative purposes. Works of this class, however, hardly fall within the scope of this paper, moreover the time at my disposal will not admit of even a very cursory glance at them.

Ground Flocks.

In factories for the production of Ground Flocks the very lowest classes of mixed rags are used—anything, in fact, in the shape of a rag which is not worth carbonising for extract wool; indeed so filthy are many of the rags, and from such doubtful sources—from a sanitary point of view—are they obtained, that the very first process is to place them in a disinfecting oven, a strong brick and iron erection, heated up to a temperature of some 250 degrees Fahrenheit.

The rags are then shaken, sorted, and taken to the Rag Grinding Machines, which I will describe to you later on. As no oil is required on the rags, the amount of dust and dirt in the machine house is enormous, despite the fact that the machines are specially fitted with exhaust trunks for removing the dust to a chamber which is almost invariably placed outside

the machine house. The ground material, instead of being driven into a "blow hole," as is the case in the preparation of mungo and shoddy, is usually delivered direct into a Flock Curler, similar to the one previously described, and the flocks, on emerging therefrom, are bagged ready for storage; the process is, therefore, practically a continuous one. The flocks in this trade almost invariably contain a large percentage of cotton, and are used for inferior upholstery and saddlery of all descriptions, as they are not so soft and pliable as the woollen flocks, although there may be much truth in the statement that, in consequence of the admixture of cotton, they are not so liable to the incursions of insects, which, we know, are occasionally apt to take up their abode in woollen flocks, and in course of time render them perfectly unfit for further use.

As fire risks, there is very considerable difference between these two branches of the flock trade, the former being, undoubtedly, immeasurably superior to the latter; but even the premises of a manufacturer of Finishers' Flocks form no light hazard, for, in addition to the storage of large quantities of inflammable material, there is considerable risk in the cleaning and curling department from friction and overheated bearings, this danger being considerably enhanced by the rapid accumulation of fibrous dust. In the works of a flock grinder, the machine room is one of the heaviest risks imaginable; for although no oil is used on the rags, and the liability to heating in the material considerably less than in mungo and shoddy, the dirty nature of the work, with its consequent accumulations of dust and "fly" largely composed of cotton, more than counterbalances this, and no doubt accounts for the fact that most flock grinders are uninsured.

MUNGO AND SHODDY.

The terms Mungo and Shoddy, in their widest sense, embrace all fibrous materials of animal origin that have been made into woollen garments and reconverted into a fibrous condition by one or other of the destructive processes hereafter referred to.

Fifty years ago the collectors of linen and cotton rags for the paper-making trade rejected all woollen and worsted rags, as at that time there was no demand whatever for them; but since the discovery that these rags can be restored to a fibrous state the trade in them has gradually increased, until at the present day

it far exceeds that in linen and cotton rags, and is relatively of greater value. In the town of Dewsbury, which is the great emporium for woollen rags, some 25,000 tons are annually sold by auction, the value thereof ranging from £6 to £50 a ton; taking a reasonable average price, therefore, of say £20 a ton, it will be seen that the total value is about £500,000. These rags, of course, come from all parts of the civilised world, and comprise almost everything in the shape of a rag, from the fragments of woollen garments worn by the inhabitants of the western globe down to portions of blankets and camel hair tents used by wandering tribes in far off eastern lands.

When the employment of these fibres was first introduced, there was considerable popular prejudice against the garments made from them, but this feeling eventually wore away, and the very low price at which manufacturers using these materials were able to place on the market the productions of their looms brought such goods within the reach of all consumers, and enormously extended the woollen trade in this and other countries. Of course at that time, as in the present day, people with sufficient means preferred to wear garments made of pure wool which lends itself to more effective combinations, has a better appearance, and possesses greater durability; on the other hand, those whose means are limited prefer the cheaper garments, in which waste products predominate; and, as limited means are the portion of the many, a great demand has been created for cheap garments, and the consequent utilisation of waste products. Moreover, so skilfully are these productions now manipulated that it is difficult for the uninitiated to distinguish between them and the genuine article.

Shoddy. As this material can claim priority over Mungo in point of age, I think it will be convenient if we consider it first. Shoddy, as most of you know, is the product of soft rags, that is, rags from such fabrics as dress goods—chiefly merinos—underclothing, shawls, blankets, flannels, stockings, comforters, and others which have not been closely milled, or have been loosely spun and woven. There appear to be several claimants to the credit and honour of this invention, but, so far as it is possible to judge, I think the particulars embodied in the following brief sketch give a fairly accurate and trustworthy account of the discovery.

At the time of the Peninsular war, owing to the stoppage of the supply of wool from Spain, and to the great demand for army goods, the price of wool in this country was driven up to a very high figure; and a Jew second-hand clothes dealer in London conceived the brilliant idea of tearing up old blankets and other white woollen goods by means of curry combs, and mixing the material thus obtained with genuine wool. This was accordingly done, and the adulterated bales sold in Yorkshire for full prices. Subsequently, when the price of wool declined, the material in question was sold for saddlery and upholstery purposes. This was probably the first progressive step towards the manufacture of Shoddy; the credit for the second step undoubtedly belongs to a Yorkshireman, a native of Batley, named Benjamin Law. On one occasion, when in London for the purpose of disposing of his goods—he was a weaver by trade—he observed some of this material in a saddler's window, and having purchased a small quantity, he took it back to Batley, where he satisfied himself that it was capable of being manufactured into useful fabrics. He then, in conjunction with his brother-in-law, Benjamin Parr, commenced to make the material. Many difficulties had, of course, to be overcome before it was possible to develop the manufacture to any extent, but from this small beginning may be traced the great industry which has created busy centres of population in this county, and which may be said to have revolutionised the woollen trade of the world.

Mungo.

Mungo is the result of grinding into a soft fibrous state rags of a hard character, such as closely milled cloths. Some ten or twelve years after Law and Parr commenced to manufacture shoddy, they made repeated attempts to utilise these hard rags, but their efforts were not rewarded with success. A few years later, however, two sons of Parr's, after many trials, succeeded in overcoming all difficulties; and it is a matter of common knowledge that this material was named Mungo from a remark made by one of the inventors. After many attempts, and as many failures, the brothers had hit upon a scheme which, theoretically at all events, promised to fulfil all requirements; but, on being put to a practical test, it met the same fate as its predecessors. "It weant go," said one of the brothers, but the other, cast in a sterner mould, replied, "But it mun go" (must go). Eventually it did,

and has since become an important—a most important—source of supply of raw material to the woollen manufacturer.

Before proceeding to describe the process by which rags are converted into Mungo and Shoddy, I may remind you that in the Woollen Mill Tariffs issued prior to 1893 the extra rate charged for the use of Shoddy was 10s., whereas the extra for Mungo was only 3s. The great difference in these rates was primarily, no doubt, due to the fact that Mungo was originally composed almost entirely of pure wool. Then, again, the Mungo was made from finer rags, and a better class of oil used in the preparation, hence less liability to spontaneous combustion in the material was assumed. In course of time, however, any well-defined line of demarcation which may at some period have existed was gradually obliterated; and when a new Woollen Mill Tariff was issued in 1893, all Mungo and Shoddy containing fibre other than animal wool and hair was placed in the class formerly occupied by Shoddy, and similar material, containing no such fibre, in the class previously occupied by Mungo,—certain limitations, governed by the kind of goods manufactured, being imposed, in order to obviate a difficulty with regard to the rating of Mills in certain districts.

RAG GRINDING.

In order to convey some tangible idea of the great importance of this trade, I may mention it has been estimated that the Rag Grinding Machines of Yorkshire alone are capable of producing, annually, raw material equivalent to the fleeces of 18,000,000 sheep (*i.e.*, between 80,000,000 and 90,000,000 lbs. of wool). Now, the total annual production of our home growth of wool for 1897 was 137,500,000 lbs. The weight of material, therefore, produced by our Yorkshire Rag Grinding Machines is equivalent to about two-thirds of the total production of wool in the United Kingdom.

The rags used in the trade are very largely imported from abroad (about 60,000,000 lbs. per annum), as they can be delivered in the West Riding from distant places—Berlin, for instance, at less cost than from London, in consequence of cheaper freightage.

The transformation of rags into Mungo or Shoddy does not involve any very complicated series of processes, as is the case in the conversion of wool to cloth. When the rags are received by the manufacturer, those which are not already in a sufficiently clean condition are well shaken in order to remove dirt and dust;

this is accomplished either by a Shaker or a Whimsey, such as you have already seen. The rags are then transferred to the sorters, who arrange them according to quality and colour, it being necessary that the various classes of rags are so blended that each kind of rag, whether red, blue, black, or grey, loses its own identity whilst undergoing the process of being converted into Mungo or Shoddy. Rags from cast-off garments, if of good quality, usually have all the seams removed (the seams, of course, being the portion of the rag containing the cotton threads used in stitching), and are then known as seamed rags. I believe, however, that probably fifty per cent. of this class of rags are pulled with the seams left in.

After these preliminary processes, the rags are oiled—in the proportion of about two gallons to one hundred pounds—in order to soften them, and to reduce friction in the process of grinding. Fig. 27 shows the machine in which this is effected.

The rags are placed as evenly as possible in a feed box, and then,

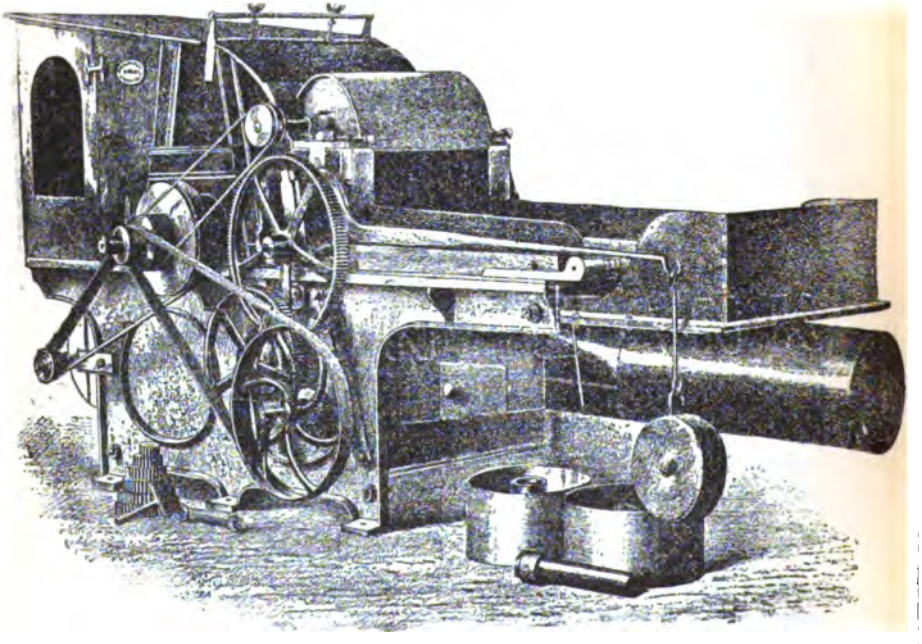


Fig. 27.—Rag Grinding Machine.

by means of a leather feed or apron, are conveyed to a pair of fluted rollers, through which they slowly pass, and on emerging at the opposite side of the rollers they are seized by the teeth of the "swift," which is a large wooden cylinder about three feet in diameter, more or less thickly studded with small iron spikes or teeth. These tear the rags into fibre and throw the material, now reduced to a flocculent woolly state, into an iron trunk, which conveys it to a small chamber known as the "blow hole." Above the feed rollers there is a small iron cylinder known as the "bitter," on which are four dull iron blades. This cylinder revolves in an opposite direction to the main swift and takes therefrom all rags which have escaped being thoroughly torn up; it then throws them out on to the feed apron again. At the back of the swift there is usually another "bitter" consisting of a fixed iron blade, which answers a similar purpose and knocks off unground or partially ground rags into the wooden box or cage at the rear of the machine, whence they are removed by hand and re-placed on the feed board. The large weights shown in the figure are not—as might be supposed by the uninitiated—for any weighing purpose, but for operating a lever, by means of which the upper feed roller is lifted, and the distance between the two rollers regulated in accordance with the thickness of the rags on the feed apron; the arrangement also prevents the rags becoming clogged in the rollers, as by raising the upper one they are conveyed directly to the swift and thrown off by one of the "bitters" referred to. I should, perhaps, also explain that the whole of the weight is thrown by the lever on to the top roller, in order that the rags may be very tightly gripped, and not pulled through the rollers by the swift.

The speed of the swift is varied according to the nature of the rags operated on. If they are hard rags for the production of Mungo, the speed is from 600 to 700 revolutions per minute. If the rags are of the soft nature used for Shoddy, the number of revolutions does not usually exceed 350. In machines, therefore, which are used for grinding Shoddy, a fan is fixed behind the swift in order to force the material through the delivery pipe to the blow-hole, as the speed of the swift is not sufficient for this purpose.

In large works, more especially those engaged to a considerable extent in the export Shoddy trade, some classes of material, after passing through the Rag Machine, are carded in the usual manner in order that the material may be more readily worked by the woollen manufacturer when delivered to him.

I need hardly tell you that rag grinding is a very hazardous process, in fact the Woollen Mill Tariff prescribes almost prohibitive rates for it, viz., £3 3s. for a shed, £5 5s. for a storeyed building, in addition to extras, frequently exigible, for the use of oil and of machines above three in number. No doubt owing to the heavy rates, and to the fact that it is frequently impossible to obtain an insurance policy on any terms, Mungo and Shoddy manufacturers have effected great improvements in the arrangement of their works, the great majority of Rag Grinding Machines being now placed in fireproof compartments or in separate shed buildings, usually of lofty construction, and in either case, as a rule, not containing more than two machines, each probably having a fireproof blow-hole; that is to say, the receptacle or small chamber into which the material is blown is constructed of brick with an iron door thereto, and an iron or flagged roof; moreover, the framework of the machine is of iron, and not infrequently the cover also. This last is, I think, a point to which considerable importance should be attached. The greatest fire-risk is of course from friction, as metal buttons, hooks, and other hard substances which have escaped the sorters' attention, will, when struck by the iron teeth of the rapidly revolving swift, give off sparks which readily ignite the material. There is also considerable danger from overheated bearings, owing to the great speed at which the machines are driven. Buttons made of celluloid—which appear to be replacing those made of bone to a certain extent—will be anything but desirable visitors in a Rag Grinding Machine.

Another risk lies in the fact that if a heap of rags moistened with any oil capable of rapidly absorbing oxygen at the ordinary temperature of a room be allowed for any reason to remain in that state for a considerable length of time, the heap will probably heat, and in due course a fire follows; the reason for this being that, as rags are poor conductors, the temperature quickly rises, the oxidation of the oil increases, and heating rapidly ensues. There is also a considerable element of risk in the baling of the material soon after grinding, as it is more or less heated by its rough treatment in the machines, and when closely packed is liable to combustion if any oil with a tendency to rapid oxidation has been used in the preparation of the material.

In the soft rags from which Shoddy is produced there is an absence of hard substances, and as it is also much more readily torn into fibre, less speed required in the machine, and the material

when ground of a very loose, open character, it will be readily understood that there is considerably less risk than in the grinding of hard rags for Mungo. I think, therefore, we may safely assume that, other hazards being equal, the risks in which Shoddy is pulled from pure woollen rags are the best of the class, then probably come the Mungo risks in which the rags operated upon are principally new rags—consisting chiefly of tailors' clippings—and by various gradations we sink to the worst classes of all, *i.e.*, the linsey-mungo grinders, the commission grinders, and the flock grinders.

CARBONISED OR EXTRACT WOOL.

Extract Wool is the third class of material obtained from rags by a destructive process, and is a discovery of later date than the reconversion of woollen rags into fibre by grinding. All rags containing cotton or other vegetable fibre were for some years after the discovery of Mungo sold to paper makers, who extracted the vegetable fibre by means of a caustic alkali which killed the woollen fibre. Some time early in the fifties, however, it appears to have occurred to several people that it would be advantageous to reverse the process; but the credit for the invention seems to be generally accorded to a captain in the merchant service named Corbett, who, after studying chemistry for some time—with this special object in view—discovered that if the rags were steeped for a short time in sulphuric acid the cotton was completely destroyed with little or no apparent damage to the woollen fibre. At first the invention was not taken up by the woollen manufacturers, as they were of opinion that the process rendered the woollen fibre too brittle for manufacturing; the material was therefore used chiefly for saddlery and upholstery purposes. Eventually, however, it was adapted to textile requirements.

At the present day there are two different methods employed for the purpose of removing the vegetable fibre.

The older or wet process, known as "extracting," consists of steeping the rags in a solution of sulphuric acid and water. They are then dried in an enclosed chamber, thus causing the water to evaporate and leaving the sulphuric acid on the rags in a very concentrated form, in which state it has a powerful carbonising action on the cotton, reducing it to a state of powder or dust, which is removed by shaking. The woollen thread is then washed to

remove the acid, and, after being dried, is opened or pulled into a fibrous condition on a Garnett or coarsely clothed carding machine.

The newer process, known as "Carbonising," is a dry one, and is now more commonly used.

The rags are first washed—though this is rarely necessary—and then very thoroughly dried, the system usually adopted to accomplish this object being to place the rags on trellised wire covered frames of the ordinary type; hot air, either from steam pipes or from a specially constructed chamber and furnace, is then drawn or driven through by a fan. The rags, after being dried in this manner, are removed to a gas-tight carbonising oven, constructed of iron and containing either frames or a revolving iron cylinder for the reception of the rags. Adjacent to the ovens are iron retorts set in brickwork over a coke furnace; in these retorts are placed either hydrochloric acid or sodium chloride (common salt) and sulphuric acid (vitriol), which on being heated give off hydrochloric acid gas very freely. This gas enters the carboniser through iron tubes, and, after passing through the material, is conducted by another series of pipes into condensers outside the building. The carbonising action of the hydrochloric acid gas is, of course, a purely chemical one, and unattended by the slightest trace of combustion; the cotton fibre, as in the process previously described, is reduced to a powdery state, which is removed by shaking, and the material is subsequently treated in the same manner.

The chief elements of fire-risk in these works appear to be in the drying processes, defects in the arrangement of the furnaces in connection therewith, in the possibility of overheated fan bearings, and in the storage of highly dried rags. The carbonising process of itself is not a dangerous one, as the hydrochloric acid gas would not support combustion and would tend to extinguish rather than accelerate a fire.

In reviewing the various works in which woollen wastes are manipulated, I have referred to some of the fire hazards peculiar to the respective risks; in addition to these there are of course the usual hazards of construction, heating, lighting, &c., common to all manufactories, and which in some form or another have already been discussed before this Society. It is, perhaps, hardly necessary therefore for me to again refer to these hazards, more especially as the majority of the members are, no doubt, thoroughly

conversant with them, but as my chief object in writing this paper is an endeavour to provide information for the younger members who may some day find themselves called upon for the first time to inspect one of these Waste Works, I will venture—even at the risk of being tedicus—to emphasise a few common hazards which require careful consideration in the estimation of these risks.

1. The construction, height, and age of the buildings, their situation, condition, and state of repair.

With the exception of warehouses, all the waste works referred to this evening should be of one lofty storey in height, with concrete floors; the only woodwork being in the doors, window-frames, and possibly the roof, though even there iron girders would be preferable. Storeyed buildings being practically uninsurable, we need not consider hazards specially applicable thereto. I may mention, however, that a few "bull's-eye" windows are still occasionally to be found in old warehouses, and the removal of these should be insisted upon, as they have been known to focus the sun's rays on waste material and set it on fire.

2. Heating and lighting arrangements.

The only form of heating permissible is by hot water (low pressure) or steam pipes, and the latter is the method almost invariably adopted, as it is undoubtedly the most convenient, steam being generally at hand. It is advisable, however, that the pipes should be open and accessible, clear of woodwork, and, if laid close to the floor, covered with some non-conducting material, as waste and sweepings are apt to accumulate in close proximity to the pipes, and if left for any length of time may very possibly ignite.

Probably the best method of lighting such premises is a satisfactory installation of the incandescent electric light, as no matches or other portable lights are required. The conductors do not help to spread a fire as gas pipes do, and there is no danger of "fly" or other loose material coming in contact with the lights. If gas is used, the bracket should be fixed quite clear of woodwork; it is also advisable for the light to be enclosed in a glass lantern, and an electric lighter (of which a supply should be kept) used for lighting up.

3. Management. I need hardly say that careful management is of paramount importance, as it is well known that many fires are caused by gross carelessness and neglect of the most ordinary precautions. Cleanliness, we are told, ranks as a virtue next to godliness, but in the management of works of this class I would be disposed to give it even a higher place, for any dirtiness or untidiness, such as failure to remove daily the waste and cleaning rags, &c., is a fatal bar to the insurance of these risks. Other points requiring attention under this heading are, the arrangement of machinery, which must not be crowded, and—together with all shafting and gearing—quite clear of woodwork; wheel-boxes, for instance, should be of iron; the avoidance of sawdust as an absorbent of the lubricating oil droppings, for, when greasy, it will undoubtedly heat; the regular lubrication of bearings, which should always be easy of access, and careful attention to the due efficiency of fire-extinguishing appliances. In this last connection I may just mention that in rag grinding places and other rooms of comparatively limited area, one of the best, if not *the* best of fire appliances is a steam pipe of about three inches in diameter with a valve operated upon from the outside of the building, as the steam will not only extinguish a fire very quickly, but it does considerably less damage than water.

In conclusion, it may be interesting to briefly summarise the various waste products referred to, and which are as follows:—

1. Woollen Waste of all descriptions.
   - Greasy waste, from which black oil is recovered, the dry residue being used as manure, and occasionally in the flock trade.
   - Clean soft waste, used as a raw material.
   - Hard thread waste, garnetted and used as a raw material by woollen manufacturers, and in the felt cloth and hat trades; also by upholsterers and saddlers.

2. Flocks of various kinds used as raw material and for bedding, upholstery, saddlery, hats, and wall papers.

3. From Rags.
   - Mungo, Shoddy, Extract Wool, } as raw material in woollen mills.
   - Ground flocks for upholstery.
   - Hearth rugs.

4. From Wool and Cloth Scourings.	Distilled oleine, wool oil, cloth oil, and black oil—used for oiling wool and/or blended woollen materials.
	Oil spirit—a solvent for paints and varnishes.
	Stearine—chiefly for curriers' dubbin.
	Pitch—a lubricant in engineering works, &c., and for electrical insulating purposes.
	Seak cake and Dry waste, for manures.

A somewhat extensive list, though I am not at all sure that it is complete. In any event, however, I think you will agree with me, that it is sufficient to prove very conclusively that the utilisation of these Waste Products of Woollen and Worsted Mills, instead of being the disgrace it was at one time considered—as regards some of these industries at all events—is a credit not only to the respective inventors, but to the age in which we live; for these discoveries now rank among the most important in an era which, more than any other in the history of the world, has brought to light inventions and improvements in almost every branch of manufacturing industry.

J. P. EDDISON.

Insurance Institute of Yorkshire.
25th February, 1898.

FLAX MILLS, IRELAND.

In an Institute which comprises representatives of the Insurance Companies in the south, centre, and north of Ireland, it is desirable that the Province of Ulster should occasionally contribute to the interest of its proceedings by providing some discussable material at one or more of the meetings of the Society. It is therefore with a sense of loyalty as well as obligation to the Insurance Institute of Ireland, respecting which I have many happy memories, that I respond to the kind invitation of the Secretary to read a paper on Flax Mills.

It is hardly necessary to the present subject, but as it appears to be the fashion in similar enquiries to vouch the "ancient and honourable history" of the trade under consideration, I bow to the fashion. There are numerous indications that Flax Culture and Linen Manufacture prospered in Egypt for many centuries. The Mummy Cloths unearthed in recent years are reputed to be as delicate in texture as the finest lawns of the present day. Solomon, among his other accomplishments, was a good judge of linen yarn, and we have it on the best authority that he purchased in the Egyptian market. It is not improbable that the linens devoted to sacred uses under the Wilderness rule were of Egyptian manufacture. So through the ages the Distaff and the Spindle were distinctive marks of extended civilisation. In comparatively modern times it was the custom among ladies to display the treasures of the Linen Press, and to vie with one another in the products of their own spinning, but it was not till the advent of the Huguenot Refugees that the Linen Manufacture attained in Ireland to anything like the proportions of an organised industry. Quite a number of these refugees, under the direction of one Louis Crommelin, settled in Lisburn in 1698. Crommelin and his two brothers are reputed to have invested a sum of £10,000 each in the culture and treatment of Flax and the production and finishing of linen cloth. They were supported

in their enterprise by King William III., who gave them an annual allowance of £800 for several years, and also advanced money on easy terms to encourage the immigration and settlement of suitable workers. Year by year the industry took deeper root, subjected, of course, to all the vicissitudes of changing fashion, but steadily progressing, until, after the introduction of steam power, the growth of Flax in the county became altogether inadequate to the needs of the spinners. Russian and Dutch Flax were imported to supplement the home supply. The area under cultivation in Russia is so very much greater than anywhere else that the Russian crop practically dominates the Flax market. In the early days Fine Flax Dressing was a well-paid occupation; not so the coarser work, however. Less skill was required in the first process, and so small were the wages paid that there was a frequent dearth of workers. By an old policy in my possession permission was, 50 years ago, given for the hand-carding of Flax by the occupants of a workhouse in the North of Ireland by candle-light. When, in the march of civilisation, gas was introduced into the workhouse, Carding was permitted to be done by gas-light, without extra charge. Tell it not in 63 Watling Street, E.C., the rate for Flax Carding by candle or gas light was 1s. 6d. per cent.! In the days of exclusive hand labour linen was the luxury of the rich. Now-a-days, when the daily output of yarn from a well-equipped mill of moderate size would encircle the earth three and three-quarter times, linen is the possession of the poor as well as the rich. Power applied to manufacture is the poor man's friend.

As it is just possible that your ideas on the subject are somewhat larger than my own, I think it right at the outset to note one or two matters which I purpose avoiding, and by inference you will gather what are the proper limitations of my present effort.

The reasons for so limiting the scope of my paper will no doubt approve themselves to you when I say regarding, for instance, Weaving Factories (which I do not intend to deal with) they are only occasionally to be met with in connection with Flax Spinning Mills. Furthermore, they vary in degrees of hazard not only according to structure and arrangement, but also according to the class of goods manufactured. In the Weaving Division itself there is a great difference between the risk of medium sheetings and a high-grade damask. Similarly the cropping-room of a

factory for the manufacture of unions is a somewhat more serious hazard than one devoted to pure linen.

Again, it is not usual, though it sometimes occurs, that a few processes assessable under the Bleach and Dye Works Tariff are associated with a Flax Mill or a Mill-cum-Factory. I do not propose to deal with these.

In Thread Mills, which are also Spinning Mills, there are a variety of processes, such as Twisting, Doubling, Thread Polishing, and Balling, all of them comparatively free from hazard, but involving a good deal of interesting description. But as the later operations incident to Thread-making do not come within the scope of my paper, I also refrain from these.

Will you permit me further, before entering on the details of Flax Spinning, to give a brief description of the Flax Plant, and some of the processes through which it passes before it is treated by the Spinner.

All who have seen Flax growing in the fields about the beginning of July will have been struck by the delicate, light-green stalks, which measure two or three feet in height, topped by a beautiful blue flower. The flower is in due time followed by globular seed vessels containing flattened and elongated slippery brown seed. The stalks are hollow tubes surrounded by a fibrous rind, the filaments of which furnish the material from which the yarn is spun, and finally the linen fabric is manufactured.

Experts say that a slow, steady growth is required to produce the best kind of fibre. When raised in hot countries the fibre is said to be wanting in delicacy and elasticity. In countries approaching the northern limits of the temperate zone the short hot summers induce too rapid a growth, and although the fibre is good it is not first-rate.

Hence the value of Irish Flax ranges from	£45 to £65.
Russian	£25 ,, £45.
French, Dutch, and Belgian . .	£55 ,, £75.
Do. Lys-steeped Courtrai . .	£50 ,, £150.

The first process after pulling the Flax is to detach the seed, and this is accomplished by putting the heads of the Flax through a machine called the Rippler. The seed thus saved is not of a good enough quality to keep for sowing. It is sold to the Oil Mill, where it is heated, the linseed oil expressed, and the residium forms a valuable oil cake for cattle feeding. I regret to say that this process is now conspicuous by its absence from

Ireland. The seed is allowed to go to waste, for what reason is best known to the farmer.

Retting. A pool of soft water is formed six weeks or so before being used, so that the water may be well softened by the action of the air. The bundles of Flax are put into the pool on their butt ends, then covered with rushes or straw to preclude the light, then held down with stones. Fermentation sets in, and the gummy, resinous matter is decomposed, so that the fibre can be separated from the woody shell without breaking. This process of retting takes from six to twenty days, according to the weather. The Flax is then carefully lifted from the steep and allowed to drain for several hours, then spread on the field, where it is allowed to lie for a few days. It is afterwards stacked or packed under cover.

In the store the Flax straw is "streaked," that is, it is laid out in even lengths preparatory to rolling. It is then passed between rotating horizontal rollers, which are fluted. These in their action crack the woody part of the stalk already loosened by the retting process, and also spread or partially separate the long fibres.

Scutching. The rolled or broken stalks are then conveyed to the Scutch Mill. The Scutching machine is of simple construction. On a single shaft, operated by a steam engine, or more usually by a water wheel, there are, say, 10 to 12 vertical wheels to which are fitted a number of wooden knife-shaped beaters; these as they rotate strike the flax held by the attendant over a fixed bar until they remove the boon or woody shell from one half of the straw. The other end is then subjected to the same process. The space between each of these series of rotating blades, or "handles," as they are technically called, is boxed in to safeguard the worker from discomfort by the dust that is thrown off by the process, and also to prevent accident from the beaters. Needless to say, there is no artificial light nor heat permitted in a Scutch Mill. Some Companies have ventured on them, under pressure, at 63s. per cent., and even less. No underwriter covets the business at any price.

Roughing. We have now reached the stage at which the Flax is bought and stored by the Flax Spinner.

The first operation to which it is subjected in his hands is called

Roughing. The Rougher's Tool or Heckle consists of a number of steel pins, very sharp at the points and seven inches in length. These are sometimes four-sided instead of round for the better separation of the fibre; they are on equal level passed through holes in a wooden block. The operator, having divided the Scutcher's Streak into small "pieces" of approximately equal size and weight, takes one of these by the middle and throws it on the steel pins, draws it towards him, spreading it at the same time with the other hand, so that it may not sink too deeply into the teeth, thus the flax is cleaned, split, and separated into fibres in parallel order, while the coarse matter or tow is removed. One half being thus heckled, the other half is turned round and similarly treated. In this process a very considerable quantity of grit and dust is given off and accumulates in the room; some hazard arises also from the movement of Flax to and from the department when contact with gas light may happen, but I fear that the chief cause of loss has been the trampled match dropped from the pocket of the worker when bending over and lifting the Flax.

Machine Heckling. The next process to which the Flax is subjected is Machine Heckling. The machine need not be described in fuller details than is necessary to understand the illustration and appreciate the hazard of the operation. There are varieties of these, single and duplex, supported by a massive iron frame. There are two Rollers, the lower of which is the largest and is the working roller which operates the Heckles. Over these rollers there are endless leather bands, usually about six feet in circumference. To these are bolted iron bars stretching the entire length of the machine, and screwed to the outer sides of these are hard wood strips fitted with heckle pins. These pins are of various grades, separately spaced, so that in, say, an eight-tool machine the Flax is heckled eight times in its rising and falling movement across the machines, each time with a finer set of heckles. The "pieces" of Flax that have been treated by the Rougher receive from him as he finishes the operation a half twist or "lap." The object of this is to simplify the work of the boy "Filler" at the Heckling Machine. He lifts two pieces of flax brought from the Rougher's bench and spreads them out on one side of an iron holder faced with rubber or flannel. The other side of the holder is then laid over and the two bolted together. He then lifts this holder into the "channel"

or "head" on the top of the machine. This head may be described as a "lifter," moving horizontally and dipping slowly to the extent of about 18 inches into the sheets of the machine. Each time it rises to its highest point a forward horizontal movement of all the holders in the machine is made to the extent of ten or eleven inches (the width of a holder), so that with each movement one holder is removed from one end of the machine and room is made for the admission of a new one at the other end. The portion of the flax that has been in the grip of the holder has now to be treated. The boy changer at the far end takes the holder containing the half dressed lot of flax from the machine, lays the dressed part over another open holder, firmly screws on the other part, unscrews the holder from the portion of the flax formerly gripped, and, lifting it into the return head or channel of the Duplex machine, subjects the second half of the flax to the process above described. This, on its arrival at the side on which it originally entered the machine, is fully dressed and is taken away. In this process there is naturally a considerable quantity of tow or broken pieces of fibre caught in the pins. These are removed by a simple, yet ingenious, arrangement of stripper rods in the lower part of the machine, or by the Brusher and Doffer arrangement, and knocked off into a tow box.

Hand Sorting. From the Machine Heckling Room the Flax is taken to the Sorting Shop. Sorting is also a form of Hand Heckling or Dressing, but with finer tools than are used in the Roughing Shop. Indeed the Sorter has two tools—one of these, a coarse heckle, called a "ten," and a finer one, for giving the finishing touch, called a Switch. Less dust is given off at this stage, practically all the woody matter and dust remaining after Scutching having been removed when in the hands of the Rougher and during Machine Heckling. To an unpractised eye the operations of the Rougher and Sorter seem very simple and hardly calling for the employment of mature men. But there is a surprising strength of arm, together with considerable judgment and nicety of touch, needed in these processes. A skilful operator can produce from 100 lbs. of well-cleaned flax, 45 lbs. to 60 lbs. of line, the remainder being tow, woody matter, and dust. A less skilful worker may produce more tow than line. The dressed material, which is now technically named "Line," is conveyed from the sorting benches to what

is termed the "Dressed Line Store," in which it is kept in wooden pockets or frames and in comparatively dim light.

Very frequently the preliminary processes of Roughing, Machine Heckling, and Sorting are carried on in buildings detached from the mill.

Preparing.

We now enter the Mill proper, and proceed to the next department, which is technically termed "Preparing." The machinery in this department is divided into what are known as systems. These vary somewhat according to the class of yarn produced, but usually of one Spread Board, three or four Drawing Frames, and one Roving Machine. The Dressed Line, in the form it is brought from the sorter, is carefully pieced out by the operator and spread on the leather feed sheets in portions, the sufficiency of which are gauged by practised touch, and regulated by the operator according to instructions received as to weight of sliver required. This is produced by the portions of line carefully lapped over each other being caught in revolving sets of gills and conveyed by a slow and steady movement forward to a double set of rollers, from which it issues in a pressed band of silky flax, which at this stage is called sliver, and falls from the machine in a continuous band into a cylindrical vessel called a sliver can. The sliver is then weighed in the cans, and a set of, say, 16 cans of equal length and weight—that is, equal length and weight of sliver—is removed to form the feed of the first drawing or "sett" frame. The work to be done on this sett frame is to regulate the weight of sliver and of the rove to be produced. On the intermediate frames, which are called the Drafting, and the last, which is called the Finishing Frame, the sliver becomes finer and lighter. This is accomplished by the delivery roller on each machine working at a greater velocity than the feed roller, so that the sliver is "drawn out." This attenuated sliver is now conveyed in cans to the Roving Frame, which, while acting as a Drawing Frame also, performs the double operation of giving a twist to the sliver—now termed "Rove"—and winds the rove on bobbins, which are afterwards fitted on the Spinning Frames. Close attention to the details of the machine is very necessary to ensure that a twist of just sufficient strength and openness be given, and that the rove be wound evenly and without strain over all the surface of the bobbin. "The method of placing the rove

"upon the bobbin is accomplished by the spindle and bobbin "revolving at different velocities in the same direction—the "difference in speed between the two being the means by "which the flyer is enabled to lap the strands round the barrel. "The bobbin at the same time slowly travels up and down the "spindle blade, so as to receive the rove in an even layer. This "traversing motion is caused by the bobbin resting on a movable "tray surrounding the spindle which contains the gearing to "drive the bobbins at the required speed, and rises and falls "regularly, causing the building of the Rove on the bobbin. It "is called a Builder, and its speed per minute and the revolutions "of the bobbins are made to vary as each layer passes on to the "bobbin, so that there may be no difference in the tension of the "rove by the alteration in the circumference of the barrel as each "row is added. The mechanism which effects this really exquisite "movement is called the differential motion."

There is no serious hazard in the "Preparing" process; comparatively little dust or flyings accumulate in a well-ventilated Preparing Room. The quantity of loose fibre in the department is limited to the supply for the spreaders; the remaining stock consists of sliver in the machines or in the cans and of rove twist on bobbins. Excepting, therefore, the usual risks from friction, there is little to be apprehended in the Preparing Rooms.

Carding.

Thus far we have confined our attention to the treatment of Rough Flax and Dressed Line. We have now to turn our attention to the operations involved in the treatment of the Tow, or short broken bits of fibre from the processes referred to, as Scutching, Roughing, Machine Heckling, and Sorting. These are, of course, of various qualities. Re-Scutched Irish Tow, for instance, is so much longer and coarser than Machine or Sorting Tows it requires to be passed through a shaker or teaser fitted with strong pins or spikes, nearly two inches in length. This machine straightens out the matted material, opens the lumps and knots, and removes the dirt. The next operation is that of the Breaker, a coarse kind of carding machine, with usually seven pins to the square inch of cylinder, in which the tow is further straightened out and naps and knots removed, and the material is finally issued in the form of sliver, and conveyed to the finishing card. A blend of several classes of tow is sometimes

effected in the Breaker or in another machine called a Breaker and Finisher, and which combines in itself the two processes of breaking and finishing medium tows.

The Carding Machine consists of a large drum, say 4 feet to 6 feet in diameter and 6 feet face, fitted with steel pins varying from 14 to 42 per square inch, according to the fineness of the tows. The cylinder revolves at a high speed, and catches the fibre as it is passed through two feed rollers from the feed sheets in front of the machine. To prevent the tow becoming embedded in the pins of the cylinder, there is a card stripper roller armed with pins hooked in the direction of the cylinder, which revolves at a high speed, and lifts the fibre from the cylinder pins, and is in turn relieved by the cylinder. There are quite a number of these in each card. At intervals, too, there are rollers slowly revolving in an opposite direction, whose pins, hooked against those of the cylinder, cut the fibre. This is again stripped and delivered on to the cylinder, and so there is a continuous alternating operation of clearing, equalising, and splitting, until, by the operation of a swiftly oscillating knife, the fibre is finally removed from the last of these rollers, called the Doffer, and then passed out of the machine in a form of sliver to be conveyed to the Preparing Department.

Fires are of frequent occurrence in Teasing and Carding Houses, but a disastrous loss in these departments very rarely happens. These minor losses are from many causes. Perhaps the most frequent is matches that have found their way among the tow, probably in the removal of the stuff from the machine where the tow was made or from the mixing-room, where the several kinds of tow have been blended before being taken to the Carding House, a match dropped from the pocket of the worker, and so found its way into the card. Similarly some hard and gritty substance may pass unnoticed with the tow. The accidental displacement of part of the Card or Doffer clothing, resulting in the striking of the pins, is another cause, and over-heated journals is yet another. All of these fully justify the high rates charged for Carding Houses.

In this connection it may be worth quoting the advice of an expert:—

"When the pit is too full of waste the fire will last so long "and such heat be generated in the card as may render it "nearly worthless by taking the temper out of the pins and

"charring the filleting. The chance of the fire spreading is also "very much increased. To guard against this latter danger "there should be one or two buckets filled with water kept at "each card to be used only for drenching the waste in the pit, "and for wetting the floor about the card to smother the sparks "in case of fire. No water should be thrown over the card nor "should it be stopped, but let work away at full speed, as this "prevents the fire settling on any particular spot, and keeps a "draught that saves the pins and clothing."

The Carded Tow being delivered in the form of Sliver the process of preparing consists of Drawing and Roving only. The Sliver passes over one, two, three, or four Drawing Frames as may be required, and the Roving Frame, and, except that the space between the various parts is reduced owing to the shortness of the fibre under treatment, the machines are very similar to those in Line Preparing, and the final production is Rove, which, like the Rove already referred to, is now conveyed to the Spinning Frames.

Hemp and Jute.

As the Flax Mills (Ireland) Tariff includes operations in Hemp and Jute, it will be necessary to give some attention to the preparation and treatment of these fibres.

With regard to the first named, which is chiefly imported from Manilla, it is only used in those mills which, in addition to Linen Yarn Spinning, manufacture strong thread or twine.

Hemp is so very hard and long in fibre it is impossible to use it for fine work until it has been softened by being passed over a series of fluted rollers, and then broken into lengths, something of the same dimensions as Flax. It is then machine-hackled in the same fashion as flax, the pins of the sheets being of a coarser and stronger quality than those used for Flax. Afterwards it is conveyed to the Spreading, Drawing, and Roving machines, as in Flax, and is invariably spun dry.

The quantity of Jute used in Ulster is very trifling, and it is consequently not treated in the most modern fashion. The fibre is extremely hard and dry. It has to be softened when it is removed from the bale, and before it can be operated with in any way. In a fully equipped Jute Mill this is done by spraying the fibre with a warmed mixture of whale and seal oil and water (in some cases a coarse mineral is substituted for seal oil) as the fibre

is passed on to the softening machine. The latter consists of a series of rollers, some fluted spirally and some straight. This process may be described as Machine Batching, and is also adopted in cord-making when unbroken streaks of Manilla Hemp are being passed over the first preparing or softening frame. The old style is known as Hand Batching or Batching in bulk, and is performed in a very different way. The Jute is streaked in equal lengths in stalls measuring, say, 10 feet by 3 feet 6 inches, and over each layer of Jute thus spread the oil is first applied then the water. In summer these are usually applied cold, but in winter they have to be heated. The batches are allowed to remain in this condition for 24 hours or more as circumstances require, so that the material may be thoroughly softened and made ready for treatment. Hemp is machine-hackled, and its tow is carded as in Flax. Jute is passed through a breaker and then through a coarse finishing card, and afterwards conveyed to the drawing and roving frames, as in the case of flax-tow, and finally dry-spun.

Of all the processes the most hazardous is Jute carding. The coarse, hard fibre induces greater friction. There is more liability to the secretion of foreign gritty matter. Card fires are consequently of frequent occurrence. Batching in bulk merits some consideration too, as there is considerable liability to overheating if the batching is effected in a confined space and in great quantity. Of course this can be easily avoided by operating over a larger area, and reducing the bulk of Jute in process, and I think it right to say that in the only mill in the North of Ireland in which Jute is used to any appreciable extent these sensible precautions are observed. Indeed, the use of Jute in any of the processes up to and including spinning is performed in a rougher fashion; the machinery is necessarily of a coarser kind; and the entire production being much less valuable than Flax, a somewhat different class of operator is employed, and the same attention in the matter of cleanliness and tidiness of arrangement is not so easily secured.

Spinning.

While in the general sense all the processes which we have described are processes preparatory to spinning, what is called Preparing, in the language of the trade, comprehends only the processes of Spreading, Drawing, and Roving. The Rove, which, as we have seen, is a thick, loosely-twisted thread wound on large bobbins, is

now conveyed to the Spinning Frames. In the earlier forms of machine, Dry-Spinning only was done, and for a certain class of yarn required for thread or twine is still done. However, that most commonly seen in modern mills is Wet Spinning. The construction of a Spinning Frame will be readily understood from the illustration. The Bobbins of Rove are placed on a series of pins called a Creel in the top of the frame. It is then unwound and passed through a trough of hot water, which extends the entire length of the frame, to soften the fibre. As it leaves the trough it is led into a guide, called the Rove Shifter, and thence on to the top or retaining rollers. From these rollers, both of which are constructed of iron, with brass bosses fluted horizontally, the Rove is received by the bottom or drawing rollers, one of which is constructed as above, the other being of wood—generally boxwood —and as these revolve at, say, ten times the surface velocity of the upper, the Rove is drawn out into a slender thread or yarn. The yarn is then passed through a thread plate and the eye of the Flyer, which is fixed to the top of the spindle. The latter, revolving at a high speed—up to 6000 revolutions per minute—gives the necessary firm twist to the yarn before it is wound on to the bobbin, which is in the centre of the spindle.

In Thread Spinning Mills several frames are fitted with cold water appliances, and there are also some Twisting Frames on which several strands of yarn are united into a strong thread, and afterwards hanked or balled for the market.

Reeling. Wet-spun yarns are removed on bobbins from the spinning frames and conveyed to the Reeling Room. In this room the yarn is wound off the bobbins on to a frame in the form of hanks, a certain number of which constitute a bundle of 60,000 yards. Hanks are divided into cuts of equal length, though varying in weight according to the fineness of the yarn, and the length is measured by an ingenious contrivance containing 100 or 120 notches, one of which is passed by each revolution of the Reel, and on passing the last a bell is rung warning the reeler that the quantity is run out. Yarn is distinguishable in the trade by numbers. For instance, a 25-lea means that 25 times 300 yards, or 4 miles and a quarter of yarn, is spun out of a single pound of flax, or a 240-lea, which is used in the manufacture of very fine cambric, there are nearly 41 miles of yarn, or as much as would stretch in single line from

Belfast to Newry, spun out of a single pound of flax. There is no special hazard incident to the Reeling Room. Most of the losses in these have probably, for the most part, been from fire originating elsewhere and conveyed to the Reeling Room. It may be that some losses have arisen there, however, and may possibly be traced to contact of yarn with naked light or the flyings and ends of yarn swept up against a steam heating pipe.

Yarn Drying. From the Reeling Room there is usually a long external iron or wood shoot to the first flat of the Yarn Drying Loft. This shoot is almost invariably provided with an iron door at the Reeling Room end, and in a few mills it has a similar door at the Drying Loft end. Most usually the Drying Lofts comprise the upper flats of a building, the ground of which is used as the Mill Boiler House. In almost all modern structures of this kind the ground floor is fireproof, and some of the older Boiler Houses have been similarly altered. In one or two instances the entire building is fireproof. There are still, however, many Boiler-cum-Yarn-Drying-Houses which are not only non-fireproof, but all the floors (and there are frequently four) above the boiler are wood trellised.

There is no department of a Flax Spinning Mill which calls for so much of a Surveyor's attention as the yarn drying. The chief reason of this is that there seems to be no finality to the varieties of the operation. The hanks of yarn sent down from the Reeling Room are hung on movable poles which rest on fixed lateral beams, and the desire of all spinners is to pass a current of heated air through the entire of these hanks so that every part may be equally dried. To attain this all sorts of heating devices have been tried from time to time. Some spinners utilise the heat from the tops of the boiler, supplemented by a few low-pressure steam pipes. Then again low-pressure steam pipes, with only a limited assistance from the boiler tops, is tried by others. Some use a forced draught of air fanned through a coil of steam pipes on a fireproof floor over the boiler, others prefer a system of high-pressure steam pipes on a non-fireproof floor over the boilers. Propelled heated air from a Sirocco stove is yet another method. In almost all, the temperature aimed at is about 115 degrees Fah.

Fires in these places may be accounted for in many ways. In the course of his rounds the operator in the drying loft changes the position of each hank, and in doing so gives it a smart jerk

or two to prevent the strands adhering to each other. This also removes from the yarn small woody particles that fall down through the trellised floor and accumulate on top of the boiler and its brick setting. By the constant process of expansion and contraction going on, there frequently happens a small breach in the setting at the back of the boiler. The red glow is quite apparent through these crevices, and it is not improbable that sparks from these catching the shoves and yarn fluff given off in the process of shaking and stripping the yarn from the poles sometimes start a fire. Again, it is no very unusual thing to see sparks occasioned by the movement of the damper inside the boiler house. Loosened yarn blown against an unprotected gas-jet, yarn carelessly laid on top of the feed pipe from the boiler, surreptitious smoking, are also probable causes of fire.

All experience points to the desirability of encouraging the Insured to make the floor over the boiler substantially fireproof. Some of the most modern Boiler-cum-Yarn-Drying-Houses are fireproof throughout, and so far in these there have been no losses. In buildings having an unperforated fireproof floor over the boiler the losses have been few, but in the buildings which are non-fireproof throughout there have been serious losses, fully justifying the Tariff rates.

The transition from the Drying Loft to the Yarn Cooling Room, into which the yarn is thrown in the loose condition in which it is stripped from the poles, is a very easy one. There is an inherent oiliness in the yarn which needs time and gradual cooling-off to assert itself. The yarn recovers its elasticity after some hours, and is then bunched in a machine called a Bundling Press, ticketed, and conveyed to the Yarn Store to await a purchaser.

By way of general summing up. It should be noted specially that a very considerable portion of the main buildings of Irish Flax Mills is fireproof. In many cases the entire structure is fireproof, and the several flats are approached by a stone staircase, the entrance doors from which are iron or wood as the circumstances may require. Unfortunately quite a number of these iron doors are of the primitive cast metal sort. The fireproofing, however, is, generally speaking, of the substantial brick arched type. The newer style of concrete and iron beams is only occasionally to be met. We are thus commonly in the position of rating the several floors, or parts of floors, of one structure in

six or seven different ways. For instance, in the plan before you, which represents one of the largest Flax Mills in the North of Ireland, you have, on the fireproof first storey of No. 29, several non-communicating compartments, rated as follows:—

Bobbin Turning at 10s. 6d.; Tow Breaking, 20s.
On the second storey, fireproof, Carding, at 20s.
" third " " Thread Finishing, at 5s.
" fourth " " Wet-Spinning, at 2s.
" fifth " non-fireproof, felt - roofed, Warping and Reeling, at 6s.

This sub-division and superior construction accounts for the comparative immunity from serious loss in what may be termed the Flax Mill proper. A few years ago a fire which consumed many tons of tow, and which evolved tremendous heat, failed to disturb the arched fireproofing in any way. Any serious losses in connection with the Flax Mill premises most usually occurs in external Heckling Shops, Flax Stores, and non-fireproof Boiler and Yarn Drying Houses.

The treatment of waste, which is a matter of some anxiety in other risks, is usually of easy solution in Flax Mills. Oily waste is confined almost entirely to the cleaners' wipes, and is, with the wood-workers' refuse, thrown into the boiler furnaces. The spinners' waste is, of course, wet and filthy; the danger associated with it is in drying after washing. This is done in the country mills over steam pipes in a house built for the purpose. In a rare instance it may be dried on the boiler settings. The Shoves, or woody matter from the earlier processes, and dry sweepings are usually bagged and sold. They are free from oily matter, but highly combustible if fire reaches them.

The Motor Drive is another of those common elements which is of interest in measuring up the hazard. The modern method of Rope Driving, made so popular by the Belfast engineers, Messrs. Combe, Barbour, & Combe, is an improvement of risks in this respect. Very usually the drive is in a walled-off fireproof compartment to itself, the only openings into the various floors of the mill being wall boxes for support of the shafting. In some of the older mills the upright shaft, with massive gearing encased in wide, oil-soaked boxing, and piercing each flat, still prevails, but with the introduction of modern high-pressure boilers and marine engines into even the

older mills, this objectionable feature is disappearing year by year.

Lubrication is also one of those common elements. We almost despair of attaining to an oil standard, and we have still to go on paying claims arising from frictional heating, largely the result of an inferior lubricant, but the incidence of risk from this source is not more common in Flax mills than in other textile factories.

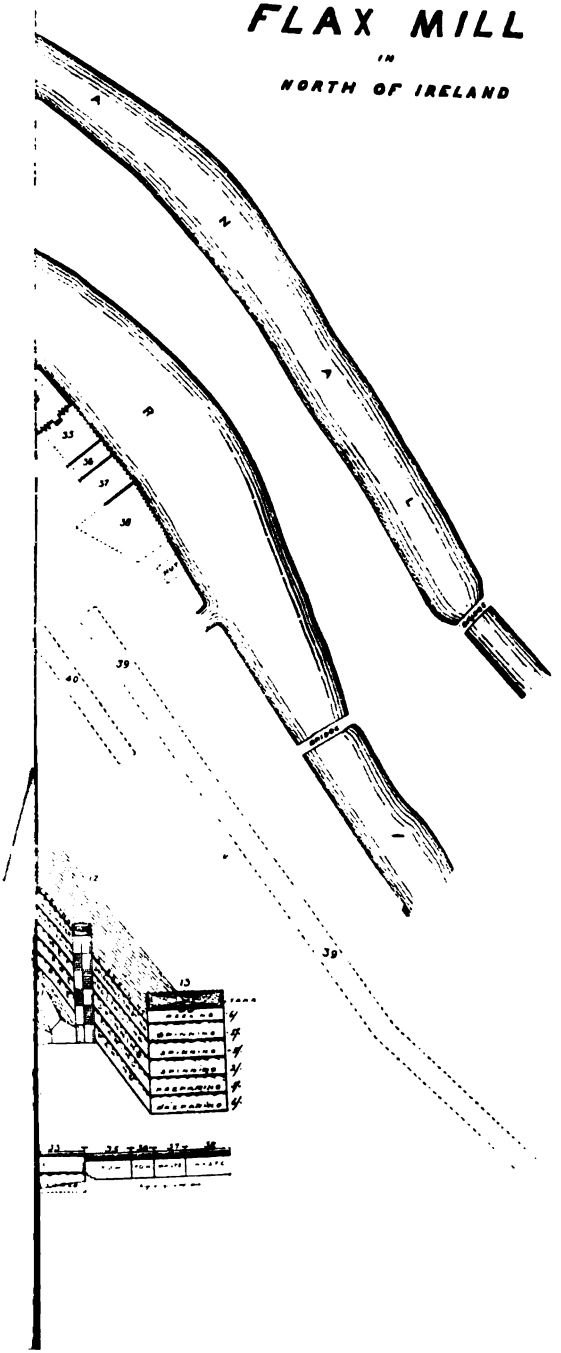
Heating is another common feature, and in this matter we have not had much trouble, as, with the exception of the Drying Lofts already referred to, heating is effected by overhead steam pipes, and in Fibre and Yarn Stores it is entirely absent.

Lighting, however, demands more attention, because here, more than in any other manufacture, do we impose a differential rating on account of light. In the mill proper there is the usual extra for lighting other than by Coal Gas, Incandescent Electric Light, or approved Arc Lamp; but in the Roughing, Sorting, Heckling, and Carding Departments the Coal Gas requires one rate and Incandescent Electricity another. Fires are not uncommon from contact of flowings with naked gas-lights, or even of batches of tow, in the course of removal from the Heckling Machines, touching the gas. On the other hand, a very unusual fire from electricity has occurred through a short circuit above an Incandescent Lamp Holder, by which the latter, in a highly heated state, fell into a quantity of tow in a Heckling House.

Flax Mills are usually protected in some shape or form by Fire Extinguishing Appliances. In the country mills, particularly where there is a good normal water pressure and no Corporation Seals to break, the mill brigades are frequently exercised in the use of the appliances, and in many instances these appliances have been very serviceable indeed. Very generally Spinners have responded to the encouragement afforded by the Scale of Discounts introduced a few years ago, and there is a growing tendency to adopt all reasonable safeguards for their own and the Companies' protection.

Quite generally, too, there has been a disposition to a fuller Insurance. The Tariff rate of 2s. per cent. for Wet Spinning Rooms encouraged many to protect them, but perhaps the chief reason for the increased insurance is the fact that many of the mills are now owned by Public Companies, and the responsibilities of Directors compel a more general protection.

PLAN
OF
FLAX MILL
IN
NORTH OF IRELAND



In these summaries I have endeavoured not to err on the side of generosity. Personally I am of opinion that Tariff legislation has gone as far as is desirable in connection with Flax Mills, and careful surveying can do all else that is necessary to maintain a favourable loss ratio.

Now, in this rather lengthy paper, I have endeavoured to comprise all that seems to me of importance in regard to Flax Mills from an Insurance point of view. Much has been omitted; much that I have said is debatable. It has been a great pleasure to me to make this little contribution to the Insurance Institute of Ireland. In the discussion that is to follow, it will be a further pleasure to be "heckled" on the many knotty points which, no doubt, have occurred to you during the reading of it.

For the samples of material now before you, and for the pictorial illustrations and the block plan, I am indebted to Messrs. Lindsay, Thomson, & Co., Prospect Mills, Belfast; Messrs. Wm. Barbour & Sons, Limited, Hilden, Lisburn; The Belfast Ropework Company, Limited; and Mr. George Horner, Clonard Foundry, Belfast.

JAMES BLACK.

Insurance Institute of Ireland,
November 15, 1901.

BAKERIES.

BEFORE entering on the subject of the evening, I should like to express my sense of the honour conferred on me by your Committee in asking me to deliver this paper. I could have wished that someone better able to deal with the matter had been chosen, but I may say that in addressing myself to the task, I have found it personally advantageous. Fire Officials are generally credited with possessing knowledge of a most versatile character, and being always primed with facts and figures which enable them to write on almost any subject under the sun at short notice. This, I suppose, accounts for my selection as the lecturer of the evening, for I am not aware of any other reason why I should be considered specially qualified to deal with "Bakeries." I trust you will not suppose it is my desire to controvert this flattering opinion, but it is, I think, admitted among ourselves that our knowledge in regard to many things is necessarily superficial, and confined to a great extent to the immediate purpose of correctly estimating the fire hazard of the particular cases coming under our notice.

On approaching the subject, I must confess that in many particulars my ideas were not very lucid, and I soon found that a visit to a number of factories would be necessary for the purpose of clearing up doubtful points. I should also like to add that, having had no experience outside of Scotland, I do not pretend to speak of the class as it is found in other parts of the Kingdom. I take it, however, that while some difference in arrangement may exist between bakeries north and south of the Tweed, these, I think, will be more a question of detail, and unlikely to be material.

It would be well, at the outset, to mention that while some firms are bread and biscuit bakers, the two branches are looked upon as distinct trades. In fact, the engineering firms making a

speciality of baking machinery, in some cases, confine themselves to one branch of the trade. The smaller tradesman, known as a "family" baker, of course always manufactures biscuits as well as bread and cakes, but he does not employ the special ovens or the machinery used in the larger factories where biscuits are turned out in large quantities.

As the most convenient method of treating the subject, I shall ask you to consider it in three sections:—

(1) The Factories: their arrangement and construction;
(2) The ovens in use; and
(3) The fire hazard and suggestions for minimising it.

I. THE FACTORIES: THEIR ARRANGEMENT AND CONSTRUCTION.

Family Bakeries.

Under this head I would include all premises for the supply of bread, biscuits, cakes, and pastries to the consumer through the medium of retail shops. Such establishments come more frequently under notice than other bakeries, as in every city, town, and village, the family baker is a necessary member of the community. Whatever is the practice in other parts of the Kingdom, baking in the household does not exist to any great extent in Scotland. Bread is retailed at so moderate a price, and is of such good quality, that few housewives now think of baking the bread for daily consumption, except in remote districts to which the tradesmen in their daily rounds do not penetrate. It must not, however, be supposed that the art has entirely dropped out of the code of modern domestic economy. Far from it; for have not most of us noticed the glow of satisfaction with which a hostess, when pressing her guests to sample her scones, cakes, and tea-bread, adds the doubtful recommendation that they are home-baked?

The Family Bakery is usually situated in a basement, or in a separate building to the rear, of a tenement of which the retail shop forms part. When located in the basement, a stair—most frequently of timber construction—provides the means of access from the shop to the bakehouse, in communication with which are the barm cellar, and the store-rooms for flour, sugar, eggs, butter, lard, and other materials required in the trade. It is seldom that Family Bakeries contain more than two or three

hand ovens, the type which is most frequently met with being what is known as the Scotch oven. Many so called improved ovens are on the market, in which hot water, steam, and hot air are the methods of heating, but the Scotch oven appears to hold a foremost place for reliable work, and, being simple in construction, it is much less likely to get out of order.

In addition to the ovens, the baking tables, with cases under, and dough troughs, form the other principal contents, together with a proving press. Where machinery is used in the manufacture, a stirring machine and a doughing machine, with an engine for working same, will form part of the plant. Cakes and biscuits, again, necessitate other machines, such as cake stirring, fruit cleaning, biscuit cutting, and brake machines and whisks.

Gas engines, and more recently electro-motors, largely constitute the motive power employed, and in the larger establishments a separate compartment will be provided for the engine. Such an arrangement is to be commended; but it frequently happens the introduction of power is an afterthought, and the workroom, which at the outset was probably none too roomy, becomes, in consequence, more crowded. The rapid development of electricity as a motive power in the larger cities should, in the future, be a great benefit to tradesmen anxious to avail themselves of the many labour-saving appliances which are on the market, but who may be prevented by considerations of space from laying down a gas engine, or the more cumbersome steam engine and boiler.

Bread Bakeries. Owing to the migration of a large proportion of our rural population to the towns and cities within the past quarter of a century, large factories devoted solely to the production of bread have sprung up in order to provide the needful supplies. The usual channels for the distribution of their goods are grocers, provision merchants, dairy keepers, and such small traders, while a number of bakery proprietors rent shops in various districts in which only their own stock is retailed. Such shops are purely for the sale of bread, and differ from the Family Bakers' risks in that no bakehouse is situate on the premises.

Within the scope of a paper such as this, it would be impossible to deal with the various stages through which bread, biscuits, and other manufactures pass before being baked in the ovens, and I propose, therefore, at this point simply to sketch the work done

in a bakery where bread is the article of production. The process begins in the barm cellar, where the barm is made and stored for use as required. It is prepared from crushed malt, flour, and hot water, a mixture known in the trade as "scald." This is allowed to cool to a certain temperature until next day, when a small quantity of matured barm is added. It then begins to ferment, and while at first it possesses a sweet taste, it becomes decidedly acid, and in two days' time is ready for use. The stock for each day when set to ferment is said to be stored, and takes, as stated, two days to mature. The small quantity of finished barm mixed in with the "scald" to assist the fermentation admits of the process being continued without break from one year's end to the other. Great care is required in regulating the temperature to prevent the barm going wrong. Barm, flour, and water are then measured out and mixed, thereafter being placed in tubs to rise. In this form it is called "quarter," and is the modern equivalent of the small piece of leaven known to Biblical students which leavened the whole lump. The tubs each contain as much quarter as is sufficient for one batch, and it is prepared for the following day's operations before the men leave off work. When the quarter is made up, there will be little more than what covers the bottom of each tub. Bags are placed over the tubs, and the warmth resulting causes the quarter to swell until it reaches about half way up the tub. When the workmen arrive the quarter is placed in a stirring machine, more flour is added, and it has become "sponge." The sponge is then placed in a doughing machine, some machines being large enough to take two sponges and about five sacks of flour, equal to 80 dozen two-pound loaves. From this machine the dough is lifted or tilted into trolleys, and is then taken to the dough divider, a machine which cuts the dough into regulation size. The desirable quality in all bread is to have it light and digestible; but the effect of the handling and working through the machines is to arrest the sponginess of the dough. It is needful, therefore, to allow time for it to recover, and the divided dough is made up, shaped like balls, then placed or "laid up" in the cases under the baking tables. This resting or recovering process is termed "proving," and were the bread to be run into the oven without subjecting it to this treatment it would be solid and unpalatable. The next step is "chaffing" or moulding the loaves into shape by hand, and again returning them to the case, the final touches being given

before placing them in the oven. These consist of imprinting each loaf with a stamp bearing the maker's name and the weight, also what is known as "buttering." This last is simply done by running a brush charged with liquefied lard lengthwise between each row of loaves as they lie in the case, and also crosswise between each second row. When the bread is drawn from the oven the loaves will be found in twos, the "buttering" having kept them separate where applied. In some localities the upper crust of the bread, when the batch is drawn from the oven, is brushed over to remove the dust and watered with another brush, thus giving it a glazed appearance. Pan loaves and fancy bread are dealt with somewhat differently in respect to the proving. The dough is placed in sheet-metal pans having close-fitting lids. The pans are then placed in racks contained in a large press constructed of wood or metal. Steam is injected when the press is closed up to assist the proving process, but in warm weather this may be dispensed with. In the smaller factories where steam is not available the method adopted is to place a pan of water over a Bunsen burner in the bottom of the press.

The large factories are well in advance of the bakeries previously described, inasmuch as the working portions are as a rule constructed with fire-resisting materials. Although they may not be erected in strict accordance with the standard laid down by the Fire Offices Committee in the rules recently issued, the improvement in construction is of such a nature that Fire Insurance officials would like to see capitalists interested in other industries show the same enterprise in improving the construction of their premises as has been done by many firms in the baking trade. The bakehouses are large and roomy, the ovens being ranged on one side, sometimes as many as 14 or 15 in line. The ovens in use for bread baking are chiefly of the Scotch type already referred to; but in order to facilitate handling the bread, double ovens are resorted to—*i.e.*, two ovens are built as one, and an economy of space effected by dispensing with the division wall between each pair. In such cases two doors are available for running and drawing the batches. For pan bread a reel oven is sometimes requisitioned. This type of oven is, however, more frequently met with in biscuit factories. The working plant in the bakehouse will comprise the baking tables and cases, sponge-stirring machine, dough-mixing machine, and dough-divider, the necessary power being derived from a steam or

gas engine partitioned off from the flat or contained in a separate building. Some bread factories comprise two or three bakehouses erected immediately over each other, in which cases it will be found that each bakehouse is a counterpart of the other, and the ovens are built with the upper tier directly over the lower tier. The flats of the building not occupied as bakehouses are, as a rule, of ordinary construction, and, being occupied for the storage of flour and other materials, there is no special feature of hazard to deal with. The flues from the ovens will be carried up in the main wall of the building or pass through these upper floors, and the necessity of a careful examination to see that all goods and empty sacks are kept well clear of the flues, and that the woodwork of the floors and roof be properly bridled, is obvious. Adjoining and communicating with the bakehouses is the bread-room or despatch-room. So soon as the bread is drawn from the oven, and after being dusted and watered, it is taken on trolleys to the bread-room, where it is loaded on vans for delivery to customers. The batches frequently arrive in the bread-room quicker than they can be loaded, in which case the bread is placed in racks. The despatch-room in many risks is match-lined, lath and plaster walls and ceilings being unsuitable owing to the steam given off by the bread causing the walls to sweat; but in modern establishments tiles or glazed bricks are now used for this purpose.

Biscuit Bakeries. The arrangement of a biscuit factory depends very much on the ground at the disposal of the firm, as well as the extent of their trade, and it is practically impossible to find two factories alike in all particulars. I purpose, therefore, to describe the separate departments common to all risks of the class, and which may, in certain circumstances, be found under one roof. In the flour store, sifting machines are used for removing any knots in the flour, and from these the flour passes to hoppers, thence by shoots to the machines in mixing-room below. The dough-mixers are either of the vertical or drum types, and in them the various other ingredients, brought from the weighing-room adjacent, are thoroughly worked up with the flour into dough. So soon as this is accomplished, the dough is tilted into trucks and wheeled to the bakehouse, where it is first put through the half-brake, a machine comprising a pair of steel rolls, fitted with reversing

gear. The machine works the dough back and forward, and it is then passed to the finishing brake. The same process is gone through here, the effect being the same as when a baker works the dough under a rolling pin. The dough is now ready for the biscuit machine, to which one or two sets of rollers may be attached, these being adjusted to the thickness of the sheet from which the biscuits are to be cut. The sheet is now fed on to an endless web which carries it under the cutters. These contain the patterns to which the biscuits are cut. They have a vertical motion and are made so that when the cutter lifts, a plate, known as the ejector, falls, causing the biscuits to drop out of the cutter back to their place on the web. The forward motion of the web is arrested while the cutter descends, but immediately it ascends the web travels forward, and the biscuits continue their progress until discharged by the web on trays. The process is automatic from the time the dough is placed in the machine, one or two attendants being required simply to see that the dough is feeding evenly and the biscuits are properly adjusted on the tray. The scrap is caught on an independent web shortly after emerging from the cutters and is delivered into a tray, being afterwards taken back to the finishing brake and worked in with fresh dough. The loaded trays are removed to the travelling ovens, where the biscuits are baked in the course of their passage through, which may occupy from 3 to 30 minutes. If the biscuits are to be packed immediately, the loaded trays, after being placed in metal racks fitted with wheels and sufficiently cooled, are removed to the packing-room, but, if not, the biscuits are stowed in wire trays and placed in the special storeroom for the purpose. In the packing-room the goods, if biscuits, are placed in tins, or, if cakes, wrapped in paper. The packing of biscuits requires to be done carefully, as it is the manufacturer's aim to place his wares in the consumers' hands in the best possible condition, and paper shavings, being clean and most suitable for the purpose, are chiefly used. It is the rule in all well regulated factories only to bring a sackful or two of the packing material into the room as wanted, and when such is the arrangement the litter will be reduced to a minimum. Some biscuits are decorated with sugar, and the room in which this is done is known as the icing-room. The icing is mixed up either by hand or in machines similar to egg-beaters, the mixture being composed of powdered sugar, albumen, and flavouring. It is spread by hand or squeezed from

cloth bags through a piping tool, and the decorated biscuits are then placed to dry in wire-bottomed trays in steam heated closets.

From the packing-room the tins are removed to the labelling room, where the labels are pasted on, a strip of paper being first fastened all round the edge of the lid in order to keep the contents air-tight. Some factories have a drying room or closet heated by steam or hot air to facilitate the drying of the labels. The finished tins are now removed to the stock-room and stored until required for the execution of orders. A very complete check is kept upon the numbers of the tins sent away each day, and as stock is taken each night, the manufacturer is able to tell from his books what varieties of biscuits are required to keep up the stock. The despatch-room staff deals with the day's orders, packing the tins in wooden cases, and here straw packing is used. Returned empties are also attended to in the despatch-room, the cases being unpacked, the tins checked off, and thereafter removed to the tin washing room, where all old labels are removed, the tins being scoured and dried over steam pipes. Many tins require squaring up, and for this purpose they are sent on to the tinsmith's shop, where machines are used for blocking the corners and sides into shape. If further repair is needed in the shape of resoldering, the tinsmith has several stoves for bolts on his workbench usually heated by gas.

Oatcake Bakeries.

In oatcake factories the work is almost wholly accomplished by hand, and the arrangement is very simple. The baking is done entirely by girls; each has a separate table or works in conjunction with a number of others at a long table, and hot-plates heated by gas or coke are erected upon which to fire the cakes as they are made. A portion of the premises will be occupied as a store for the materials used, such as oatmeal, butter, lard, salt, etc., and a packing-room, in which the cakes are wrapped, or placed in tins, practically completes the establishment. Many biscuit bakers have one or two hot-plates for oatcakes in their bakehouses, while others have separate buildings for the purpose. Some firms have taken up this trade, and, making a speciality of it, confine themselves to oatcakes alone; but, so far as I can learn, they are few in number.

Construction. All bakeries may be considered of substantial construction, the exterior walls being seldom of materials other than stone or brick. The floors of the bakehouses in the vicinity of the ovens are invariably of incombustible materials, and in all modern factories the floor over is also constructed of fire-resisting materials. This arrangement is one which proprietors now recognise as being desirable in their own interests, apart from considerations of security from fire; for when ovens are placed on the ground floor with a timber floor over, the heat in the floor immediately over the ovens is so great that it cannot be used as a workroom unless a considerable air space exists between the top of the oven and the ceiling. This difficulty, I believe, is not entirely overcome with so-called fireproof floors, concrete being to some extent—and contrary to generally accepted ideas—a conductor of heat. It is claimed for one system of fireproofing that this heating of the floor is avoided by the introduction of terra-cotta tiles made in the form of hollow semi-arches. Two of these go to bridge over each space between the joists, and the air channels thus formed connect with other channels running transversely, which, in turn, communicate with the outer air by means of small gratings. In the older risks, where the buildings are of ordinary construction and the floors are single boarded, the woodwork becomes dessicated through the action of the heat, and a fire once started the property is speedily alight from ground floor to roof.

The ideal biscuit factory is, in my opinion, to be found in the shed risk, with lofty roofs, and the various departments divided off by means of party walls carried up through the roofs, all communications being protected by fireproof doors; but, as all large establishments are located in important centres where the question of ground values is of prime importance, very few bakeries of this type exist, and the alternative is the building with fire-resisting floors, of which there is now a goodly number. As in the case of bread bakeries, proprietors in this trade have shown a considerable degree of enterprise in adopting superior methods of construction when making extensions to existing premises or erecting new factories, and this, I am glad to say, has resulted in marked improvement as regard the experience of the Offices, as, so far as I have been able to ascertain, no serious fire has occurred in a building with fire-resisting floors. Quite a variety of forms of such floors are available, one of which I have already alluded to;

but that most frequently met is made up of concrete composed of cement and coke breeze supported on wrought iron or steel beams carried upon cast or wrought-iron columns. The ironwork is generally left exposed—at any rate, it is rarely the case that the supporting columns are encased in plaster or concrete, and therefore such construction cannot be looked upon as fireproof. Now, however, that a standard has been laid down by the Fire Offices Committee, no doubt the erection of new buildings will be regulated by it, and still greater improvements in the class will develop in the future. The thickness of the concrete is, as a rule, about nine inches, and as the chief hazard lies in the bakehouse proper, where no great accumulation of combustible material occurs, it is unlikely that a fire occurring there would be so fierce as to cause the roof over to collapse. This point, however, has yet to be definitely settled, as, so far as my information goes, no instance has occurred in Scotland of a fire-resisting floor failing to stop the progress of a fire in a bakery. It is not improbable that a serious fire taking place in the floors or lofts over a bakehouse might, by the falling in of the roof and upper walls, cause the fire-resisting floors to give way. Such disasters have occurred in "fireproof" factories in other trades, but the collapse has, I believe, been principally due to heavy machinery falling through one of the floors, and the sudden strain being too much for the lower floors, they also collapsed.

Floor Openings. These occur in the form of stairs, hoists, traps, and flour shoots, and in buildings of ordinary construction their existence accelerates the spread of a fire in an alarming degree. The protection of hoist openings by brick walls having fireproof doors to all openings, and the erection of stone stairs enclosed in brick walls, form effective separations between the flats where fire-resisting floors exist. Unenclosed stairs or wooden hoists are, however, frequently found passing through incombustible floors, and their existence is, of course, a serious flaw in a building which is otherwise satisfactory in construction. As regards shoots for passing flour from the lofts to the dough-mixing machines, and traps for hoisting, these should be guarded by metal shuts or flaps where the floors are incombustible, in order not to destroy the value of the floors as efficient fire stops.

II. THE OVENS IN USE.

Scotch Oven. The Scotch oven is built in the form of a parallelogram 12 to 13 feet long by 8 to 9 feet broad when single, and 16 to 18 feet when double. It should be explained that all ovens are not of these sizes, but are varied according to the space available. The oven is built of fire-clay brick, the sides and back walls being nine inches thick except where the ovens form part of the building fabric; and the front wall, containing the flue, which leaves the oven at a convenient height above the sole, about two feet thick. The flue is usually carried back over the arch and led into the upright vent in the rear wall of the building. This, however, is not the invariable practice, as the chimneys are, in some instances, taken straight up through the flour lofts and through the roof. The first method has the advantage of economising space in the upper floors, but, when at all possible, the builder prefers to have the ovens erected in an annexe, the doors only of the ovens communicating with the bakehouse proper. The sole of the oven and "cuist," or lower tier in the side walls, are composed of a special stone hewn in cubes, and these are laid upon a layer of dry sand several inches thick, which again is laid over tightly-packed rubble-work resting on a concrete foundation. After the sole is laid and the walls constructed, a centring of sand is used upon which the oven arch is built, and when the arch is completed and set, the sand is removed by the oven door. Some ovens are fitted with doors flush with the outer walls, but the commonest type will be found with the mouth recessed. The oven fire is placed upon a grid in one of the front corners, and is kept in position by an iron fender. The ashpit opens under the furnace, and in modern ovens is provided with an iron door—an improvement which, if adopted generally, would prevent many fires caused by live cinders rolling out. Some types of newer ovens are also fitted with an iron door for stoking the furnace from the outside, an arrangement that makes for greater cleanliness in working the oven. Gaswork char is burned in the ovens, as it is of the utmost importance that no soot should be created, which would be the case were ordinary coal used. A gas jet at the door, which can be turned into the oven when running or drawing the batches, provides the necessary light.

Vienna Oven. This oven, as its name implies, is used for baking Vienna bread, which is remarkable for its lightness and fine crust. The oven is an improvement of the Scotch oven, and the chief feature is that the sole slopes up towards the back, the total incline being about 9 inches. The door is in two halves, the reason for this being that steam is injected into the oven, preventing the crust becoming hard as in ordinary bread, and the loaves near the front can be drawn through the lower half door without allowing the steam to escape until the whole batch is drawn.

Steam-Heated Ovens. These are similar in construction to hand ovens, but the fire is placed under the sole, the steam being generated in hermetically sealed pipes which pass round the fire in a coil, and from thence under the oven sole up round the sides and over the top. Frequently this oven is of the double-deck type—practically two ovens, one over the other—and in this case the pipes are ranged along the roof of the lower deck, an arrangement which admits of heating the sole of the upper deck, and then over the roof of the upper deck. The heating is effected by the conversion of water in the pipes into superheated steam, which will sometimes reach a pressure of 2000 lbs. to the square inch. The pipes are of very strong wrought iron or steel, being tested up to 3000 lbs. to the square inch, but, as may be expected, they do occasionally give way, and on this account many bakers look upon the system with disfavour.

Draw-Plate Ovens Vary in size according to circumstances, and are heated in practically the same manner as those last described, the arrangement of the oven, however, being in other respects dissimilar. The furnace is placed at the rear of the oven, if possible outside, and the end of each range of pipes projects into the furnace chamber, which is built off by a brick wall varying in thickness from 26 to 14 inches. The oven proper opens into the bakehouse by means of an iron door hung upon hinges, and the goods are placed upon a carriage which is fitted with small wheels running upon rails fixed in the oven—the front of the carriage having two legs also fitted with wheels which run upon rails set flush with the bakehouse floor. When the plate forming the

body of the carriage is filled, the door is lifted and the whole is run into the oven, only the front portion with the legs projecting, and so soon as the batch is ready for drawing, the process is reversed. The advantage claimed for this oven is the uniformity with which the goods are baked, the ease with which the bread is set and drawn, coupled with the cleanliness of the operations and small consumption of fuel. Some of these ovens are also of a double-deck pattern, in which case the lower carriage is set down upon runners, while the upper carriage is supported on hangers to which wheels are fitted to run upon overhead rails.

The ovens previously described are used chiefly for baking plain and fancy bread, pastries and cakes, while the following are almost exclusively used for biscuits.

Travelling Oven. The standard pattern of oven in use is about 40 feet long, 12 feet wide, and 8 feet high above the bakehouse floor. The furnaces, two in number, are sunk below the floor level in a chamber constructed entirely of incombustible material situated near the end where the trays are fed into the oven. The furnaces vent into the main flues which run the whole length under and over the oven, and are connected by a smaller flue on the side furthest away from the fire, where the flues are led down and are taken off to the chimney stalk. By a series of dampers at each end, the heat in both top and bottom flues can be regulated according to the class of goods in hand, and in some ovens all the heat can be passed along the bottom or the top at will. The whole oven is built of brick and iron, the interior brickwork being of best fire-brick, while the exterior is usually of glazed brick. The roof of the lower flue is flat, and as a rule of iron plates over which is placed fire-clay tiles, the effect of which is to reduce the intensity of the flames striking on the metal plate, while in the upper flue the roof is formed of arched brickwork which deflects the heat upon the curved metal plate forming the sole of the flue and the roof of the baking chamber. An arrangement of endless chains conveys the goods through the oven, the loaded trays being placed thereon at one end and lifted off at the other. A door at each end keeps the heated air from escaping, and only sufficient room is left to pass the trays in and out. The movement is effected by a belt from the shafting to a cone gearing, which can be regulated to speeds varying from 3 minutes up to 30 or 35 minutes. Some

firms adopt the travelling oven for baking cakes, in which cases this cone gearing is adjusted for lengthier periods. As the biscuits are baked in their passage once through the oven, it is obvious that the heat raised in a travelling oven will be higher than in a hand oven, the temperature in the one will vary, according to the work done, from 550° to 650°, while in the other 450° to 500° may be considered the usual range. A small steam pipe is passed into the travelling oven and loose steam is played upon the biscuits to produce what the bakers call a "bloom." This also tones down the strong heat to which they are subjected on entry into the oven, the object being to have the goods fired right through and not merely scorched on the outside. Travelling ovens are not suitable for placing on upper floors, and it is most desirable that they be built in lofty one-storey buildings, or where this cannot be done, that the floor over be of incombustible materials.

Reel Oven. This type of oven is not frequently met with, although the number in use is on the increase. It is an American idea, and for certain classes of work it appears to be very suitable. Cakes, biscuits, and pan loaves may all be baked in it with satisfactory results. The arrangement, as its name suggests, is a large wheel, say 16 feet by 10 feet, enclosed in a large brick arched chamber; the furnaces are placed at the lowest point, the heat being conveyed in flues across to the back wall of the chamber. When the fire is perfectly clear the damper in the main flue is shut down and the heat is passed directly into the oven, venting off by a relief flue at the top. The wheel has twelve swing trays or less, in proportion to the size of the reel, and these are loaded and drawn by the door, which is placed at a point slightly below the axis of the wheel. If biscuits are being baked, the wheel is stopped as each tray comes round, the tray is then unloaded, filled afresh, and the wheel is set in motion until the next tray comes up. In this way each lot remains in the oven just so long as the other eleven trays are being dealt with, and by the time the twelfth tray comes round the biscuits are ready. When cakes or bread are baked in a reel oven the wheel is set in motion and kept revolving for the time required to completely bake the goods.

Hot Plate. In oatcake bakeries the hot-plate is the one form of baking appliance in use, but there are quite a variety of patterns. It may be brick built, or wholly of metal. In the latter case heat is obtained by Bunsen gas burners or high-pressure hot water. The brick-built hot plate is in considerable favour, owing to its cheapness in working and good results. While the gas plates are perhaps cleaner and more easily heated, the cost of fuel possibly outweighs the advantages, unless the firm have a gas-producing plant of their own. Gas hot-plates are constructed on an iron frame-work and have the burners placed in a metal casing perforated on all sides to admit air necessary for the working of the burners. The high-pressure hot water plate has the arrangement of pipes running under the plate, which is in two sections, one on each side of the furnace, inside of which the pipes are coiled. The two plates are slightly inclined, the pipes being hermetically sealed and containing only so much water that when it is expanded to its fullest extent the pipes are completely filled. The pipes are similar to those employed in the high-pressure steam ovens already alluded to, and the advantage of this apparatus is that a smaller fire suffices for heating a greater area than is required in the ordinary fire heated hot-plate. The brick-built hot-plate is usually about eight feet long and four feet broad, with a metal plate about 1½ inches thick on top. The fire is placed at one end and the flue is stepped up gradually as it nears the end furthest from the fire, so that the heat is evenly distributed over the whole plate. Over the fire is fitted a perforated fire-clay slab, known as a baffle-plate, to prevent the flames striking directly on the plate and so scorching the cakes. Some hot-plates have small vent holes at the sides in which metal boxes with hinged flaps on the outer ends are placed to regulate the heat.

III. THE FIRE HAZARD AND SUGGESTIONS FOR MINIMISING IT.

In estimating the hazard, it is generally admitted that past experience is the safest, and, indeed, the only reliable index; and while it is impossible to obtain complete data as to results, profitable or otherwise, without having access to the figures of all the Companies, I have been enabled to secure, through the

courtesy of several of our Assessors, a good deal of information which, I think, may be interesting, revealing, as it does, the chief and peculiar features of hazard to which Bakeries are exposed. The cases of which I have particulars number 250, and have occurred in Scotland within the past twenty-two years. They do not include all fires which have occurred in the class during that period, but it may reasonably be claimed that they are representative cases, and if complete details had been available the net results would, I venture to think, not be materially altered.

I have tabulated the causes and placed them, according to their importance, numerically, the percentages being annexed.—

No. of Fires.	Cause.	Per cent. of Total.
32	Hot ashes, sparks, or live coal dropping from furnace	12·8
31	Careless use of lights, or smoking ..	12·4
28	Defective construction of oven, hot plate, or flue	11·2
22	Blow down	8·8
15	Fire in adjoining premises	6
15	Heat from boiler, hot plate, oven, or flue	6
13	Setters taken from oven	5·2
10	Steam press taking fire	4
9	Firewood in, or combustible material placed on top of oven	3·6
7	Escape of gas, or gas explosion ..	2·8
4	Insecure gas lights	1·6
4	Spark from chimney igniting roof ..	1·6
2	Roof of oven giving way	0·8
2	Inflammable material boiling over, such as sugar and fat	0·8
2	Vermin upsetting matches	0·8
2	Spark descending unused vent ..	0·8
1	Lightning-stalk damaged	0·4
1	Gas stove overheated	0·4
1	Heating apparatus	0·4
49	Unknown	19·6
250		100

Extracting the same information from the records of the Glasgow Salvage Corps over a period of 27 years, and, of course, dealing with fires occuring in the Glasgow area, I find the result to be :—

No. of Fires.	Cause.	Per cent. of Total.
28	Heat from oven, boiler, hot plate, or flue	18·92
23	Defective construction of oven, hot plate, or flue	15·54
22	Hot ashes or live coal dropping from furnace	14·86
13	Setters taken from oven	8·78
10	Insecure gas lights	6·76
9	Careless use of lights, or smoking ..	6·08
4	Spark descending unused vent ..	2·69
3	Inflammable material boiling over, such as sugar and fat	2·03
3	Gas stove overheated	2·03
3	Gas escape or explosion	2·03
1	Firewood in, or combustible material placed on top of oven	0·68
1	Spark from chimney	0·68
28	Unknown	18·92
148		100

From the foregoing it is obvious that the chief features of hazard are :—

(1) Hot ashes, sparks, and live coals dropping from fire.
(2) Defective construction of ovens, etc.
(3) Blow downs.
(4) Setters used in the oven.
(5) Steam presses.
(6) Combustible materials placed over the oven.

The other causes of fire might also be set down, but they are not peculiar to Bakery risks. I should, however, like to deal with those which should be specially guarded against, and which, as has been demonstrated, are most prolific in causing loss to the Fire Offices.

Hot Ashes and Live Coal dropping from Fire.

The practice of allowing ashes to be kept in wooden boxes or barrels is, as we all know, not confined to bakehouses, but fire is likely to originate from this cause more frequently in bakehouses for the reason that the fires are not usually allowed to go out, but are damped for the night, and in the morning, when the fire is raked, live cinders will drop out and be put with the others into the receptacle, which should, therefore, invariably be of metal.

In bread bakeries, or where it is necessary to prepare sponges for buns, "cookies," rusks, or the like, the sponge tub is covered with a flour sack and placed near the oven mouth. A spark or live coal falling from the fire alights on the sack or against the tub and causes a fire which could be prevented by fitting an iron door on the ashpit.

Defective Construction of Ovens, &c.

The presence of woodwork near a flue or in close proximity to the oven is sooner or later sure to be a source of serious trouble, and it is most essential that the course of the flue be traced from the oven to the point at which the chimney passes through the roof. All joists should be carefully bridled in the neighbourhood of a flue from an oven, boiler, or hot-plate; and the practice of resting joists in fireclay shoes is not satisfactory when such fires are in question, as the heat is much greater than in common vents. Buildings erected specially for the trade do not usually create uneasiness in this respect, as the special requirements of the case are well understood and provision made accordingly. It is, however, when buildings are adapted the risk becomes great, and the ingenious contrivances in the shape of sheet-metal and fireclay pipes which a surveyor comes across doing duty for properly-built flues are at times enough to stagger the Fire Manager. On no account should ovens, hot-plates, or steam boilers be allowed to be erected on a wooden floor. In one particular case which came under my own notice some hot-plates were built upon two courses of fireclay tiles about six inches thick, with an air space under the ash-tray. About two years after their erection it was found that the floor was on fire, and but for the discovery being made during the day the premises would have been destroyed. As it was, the hot-plates had to be taken down, the wood flooring cut out, and a fireproof section substituted upon which the plates were re-erected.

Blow Downs

Are the result of back draughts blowing the fire down through the grid and causing it to lick any materials of a combustible nature, such as sponge tubs or setters lying in the vicinity of the oven. This may easily be prevented by fitting a door on the ashpit, as is the case in new ovens. This cause of fire is not infrequent in the case of steam boiler houses, and the desirability of keeping the firing place well clear of anything likely to ignite is well understood.

Setters.

The putting of the batches of bread into the ovens is termed "running," and in order to keep the loaves off the walls long battens of timber are placed at the back and sides of the oven; short lengths are also placed in front, and at no great distance from the furnace, as a protection to the bread. These are termed setters, and, owing to the great heat to which they are subjected, they are soon charred. Moreover, they frequently are removed from the oven actually alight, and their careful disposal is a matter of primary importance. In large bakeries where the buildings have incombustible floors this risk is very easily overcome; but in the smaller and crowded premises it is well that the surveyor should make careful inquiry as to the storage of these fire-brands.

Steam Presses.

These are used for "proving" buns and other small bread, to which reference has already been made, and in all the cases of fires caused by them it appears that the fire has originated through the Bunsen burner being left alight. As a consequence, the water in the pan placed over soon becomes entirely evaporated, and the pan with the zinc lining of the press becomes red hot, firing the outer woodwork of the press. As the burner is practically shut up in a cupboard and liable to be neglected, the provision of a proving press wholly constructed of metal is most advisable.

Combustible Material placed over the Oven.

On the face of it, it may appear somewhat remarkable that the fires arising from this cause are not of more frequent occurrence; but it has been the practice generally to insert in policies a warranty against this practice, and this, no doubt, is the explanation. It does not require much sagacity to see the danger of placing firewood to

dry over an oven in which 450 or 500 degrees of heat are raised, but still there are apparently some people not possessed even of such a modicum of wisdom, and the surveyor who drops upon such does well if he gives his risk a wide berth.

These are the important causes so far as known; the others, being due chiefly to want of care or inefficient management, are to be met with in all risks, and it is unnecessary to deal with them here.

Another factor which should be taken into consideration in the fire hazard in this class is the situation.

Situation.

It is generally conceded that the situation of a building in the heart of a block, or so placed that the presence of fire is not discovered until the building is well alight, is a serious defect. I may mention that out of the 250 fires of which I have collected data, 155 occurred between the hours of 6 p.m. and 6 a.m., 54 occurred between 6 a.m. and 6 p.m., the time not being stated in the remaining 41 cases; but the assumption is, I think, permissible that a preponderance of these would happen during the night. With this fact before us, it will be admitted that the situation of the buildings ought to be considered as having an important bearing in gauging the fire risk.

It is satisfactory to know that since 1894, among the cases I have collected only two fires of a greater magnitude than £1000 have occurred in the baking trade in Scotland. I am inclined to set this satisfactory state of affairs down to the fact that the business is a profitable one and the firms engaged take all possible means of protecting their premises, and do not scruple to improve the construction and arrangements in their factories. A very large export trade is done by all biscuit manufacturers, and a fire would spell disaster to them as well as loss to their insuring Companies. Therefore, fire appliances in the shape of hydrants and hose, fire-pails and hand-pumps are found in most well-appointed bakeries.

Such appliances are doubtless most valuable when the staff are on the premises, but as it happens that the greater proportion of fires occur during the night, and bakehouses of ordinary construction are in a condition to spread fire so rapidly, sprinklers are, in my opinion, the most efficient form of appliances suitable

to their case. The general adoption of sprinklers in the class is, however, still in the future, the discounts granted from current rates being such, that, unless the firm are disposed from consideration of their trade to erect an installation, the return is insufficient to cover interest and sinking fund charges. I find that in bread bakeries the average rate works out at slightly under 5s. per cent.—to be exact, 4s. 8d. per cent.—while in biscuit bakeries (including such risks as are also occupied as bread bakeries on the same premises) 7s. 9d. per cent. is the average. From these rates it will be obvious that a discount of say 30 per cent. would not be considered a good investment.

The question whether bakery risks have been a profitable class is one which I should like to be able to answer, but as this can only be done by obtaining the premiums and losses from all Offices, it must be left an open question meantime. I may say, however, that on extracting from the books of the Society I represent, the total premiums paid by the various biscuit manufacturing firms, and which comprise most of the largest in Scotland, I have come to the conclusion that, over the period I have had under review, the underwriting has not resulted in a profit to the Fire Offices, so far as biscuit bakeries are concerned. I believe, however, family or bread bakeries have, on the other hand, shown satisfactory results, as the losses have been much lighter in the aggregate, and although, as regards numbers, they are in the ratio of 16 to 1, the class is so much more numerous that a proportionally higher income is received.

I have prepared the following table showing the proportion of the 250 losses, to which reference has already been made, due to fires in bread and biscuit factories, classified according to magnitude, and which may be of some interest:—

Bread Bakeries.

1	Loss of	£5,728
33	Losses over £200 but under £1,000 ..	14,917
19	„ „ 100 „ 200 ..	2,710
40	„ „ 50 „ 100 ..	3,002
142	„ under 50	2,371
235	Losses, aggregating	£28,728
	Average Loss, ..	£122

Biscuit Bakeries.

1	Loss of	..	..	..	£17,084
3	Losses over	£5,000	but under	£10,000	19,932
4	,, ,,	1,000	,,	2,000	5,328
1	Loss ,,	200	,,	1,000	250
1	,, ,,	100	,,	200	199
1	,, ,,	50	,,	100	62
4	Losses under	50	..	..	50
15	Losses, aggregating	..	..	..	£42,905
			Average Loss,	..	£2,193

As a matter of fact the loss of £5728 put against bread bakers occurred in a bakery, part of which was sub-let to a firm of biscuit bakers who had suffered a serious loss, and the fire was caused through the overheating of an oven. Possibly that loss should be set against biscuit bakers, and if that were done, not one loss of more than £1000 would appear to have occurred in the whole 235 cases, and the average for each fire would be reduced for bread bakers to under £100.

A. M. CLYDESDALE.

Insurance and Acturial Society of Glasgow,
March 10, 1902.

A FEW NOTES ON CONFECTIONERY WORKS.

THIS subject is one which does not readily lend itself to detailed description, as the risks are usually of a simple character.

It is only possible to generalise on them, and the chief object of my few notes will be to direct attention to the unprofitable experience as regards losses, in the hope of improved rates resulting for their Insurance.

The classification in our registers is very comprehensive, including, as it does, Sugar Boilers, Sweet Manufacturers, Preserve and Marmalade Works, and the like.

An important class of property is thus covered, but, unfortunately, a non-paying class, so far as the Fire Offices are concerned. Yet, curiously enough, some Offices are keen competitors for the Insurance of large works even at the rates which at present obtain.

The absence of combination on the part of Branch Managers goes far to perpetuate the low rates at present current for many classes of risk. I feel sure it is not the feeling of Head Offices, but rather the desire on the part of some Branch Managers, to increase their income, or perhaps to oblige some important connection, which leads to the low rates now prevalent.

I am of course alluding more particularly to large Insurances, where there is practically sufficient for every Office, and where a little consultation and cohesion would result in satisfactory rates of premium being obtained.

In the provinces, perhaps more than in the Metropolitan area, we find a number of small Manufacturers of Sweets. Their premises, in the first instance, have consisted of buildings not originally intended for the purpose of such a trade. As business has increased, house to house has been added, and consequently crowded and congested premises exist, in addition to a combination of undesirable hazards, such as—Sugar-boiling in pans over coke fires; steam-heated drying stoves supplied from a boiler

inside the building; old floors saturated with droppings from the tables; gas jets insecure; packing by straw carried on; wood hoists through the floors; etc.

In the more modern works, where the buildings have been specially erected, we find they run to three or four storeys in height, on account of the value of land. In these cases some attempt has been made to reduce the risk of fire. The sugar-boiling is done by steam jacketed pans; drying stoves are more carefully constructed in bricked-off compartments; the steam boiler is placed in a detached building; electric light is used instead of gas; no packing is done within the main risk; and the hoist is constructed of brick, with each opening protected.

The principal defects in a risk of this kind are the height of the buildings; steam pipes not clear of woodwork; cardboard box-making carried on; machinery used for sugar-grinding and for making different kinds of sweets; also the element of risk from oily waste; and from past experience we find that if a fire occurs in a work of this description it involves almost total destruction.

Fortunately there is a growing disposition on the part of large manufacturers to get away from a town, with its heavy rates and taxes, into the adjacent country, where they are able to acquire sufficient land on which to erect shed factories with concrete floors. Having plenty of room they are able to sub-divide the different classes of manufacture and take all possible precautions against fire.

Such works obviously come under a different category from those previously mentioned, and they are entitled to favourable consideration. At the same time I am inclined to think even these risks have hitherto been too leniently treated in regard to rating.

An important consideration is the distance of the works from an adequately equipped and efficient fire brigade. They may have at their disposal an intermittent water supply, and even at the best an inadequate pressure in the mains. Then, too, the direction of the prevailing wind in these outlying districts should be considered. Some are very exposed, and, under adverse conditions, a fire even in a shed building might result in the practical destruction of the premises.

By the kind assistance of friends in other Insurance centres, I am able to give some idea of the losses sustained during the past ten years in this class of Insurance. Unfortunately, the figures for London and the home counties are not obtainable;

neither is it possible to estimate the premiums derived from the risks during that period. The general impression, however, is that they fall far short of the amount of the losses sustained.

District.	Number of Fires.	Losses.
North of England, - - -	2	£12,440
Glasgow, - - - - -	16	28,680
Liverpool, - - - - -	1	3,000
Manchester, - - - - -	10	16,456
Yorkshire, - - - - -	3	1,500
Birmingham, - - - -	4	3,340
Leicester, - - - - -	1	4,700
West of England, - - - -	2	20,031
	39	£90,147
There were two fires in the 80's at Plymouth, - - - -	2	21,850
	41	£111,997

It is significant that in few cases could the cause of fire be ascertained; the majority are returned as "cause unknown."

The class of risk is probably not of sufficient importance to justify a Tariff, but some agreement might be arrived at on the basis of minimum charges. As a guide I have ventured to submit the following suggestions as to rating.

For Manufactories of more than One Storey in Height.

Normal rate, - - - - - - 7s. 6d. per cent.

Additional Rates.

1. Defective construction, - - - 1s. 0d. per cent.
2. Lighting other than gas or electric light, 1s. 0d. ,,
3. Height, for each storey above one, - 2s. 6d. ,,
4. Fire heat, or boiler inside, - - 2s. 6d. ,,
5. Hoist, - - - - - - - 1s. 0d. ,,
6. Steam drying (4 and 6 not cumulative), 1s. 6d. ,,
7. Packing inside the building, - - 2s. 6d. ,,
8. Cardboard box-making, - - - 2s. 6d. ,,

FOR SHED MANUFACTORIES OF ONE STOREY IN HEIGHT.

Normal rate, - - - - - - 5s. 0d. per cent.
And such of the Additional Rates as apply.

The effect of this would be that in the case of a building of three storeys, old style, we should probably have a minimum rate of 18s. 6d. per cent., viz. :—

Normal, - - -	7s. 6d.
Height, - - - -	5s. 0d.
Fire heat, - - -	2s. 6d.
Hoist, - - -	1s. 0d.
Packing, - - -	2s. 6d.

If cardboard box-making was also carried on, we should have an extra 2s. 6d. per cent., making 21s. per cent., which might be considered a fair rate.

The manufacturer would probably remove the packing to an outside building (which would greatly improve the risk, from our point of view) and possibly discontinue cardboard box-making, in which event the rate would be 16s. per cent.; more than one risk of this kind is to my knowledge at present insured at 10s. 6d. per cent., and in one instance the packing is carried on inside the main building.

In the case of Shed Manufactories the rate would probably be 6s. 6d. per cent., viz., Normal, 5s.; Steam Drying, 1s. 6d. If, as appears to be a growing tendency, the sheds have a "Belfast" roof, the rate would be 7s. 6d. per cent. (Normal, 5s.; Defective Construction, 1s.; Steam Drying, 1s. 6d.), which cannot be considered excessive. Risks of this kind are at present rated at 3s. 6d. to 4s. 6d. per cent.

In conclusion, may I express a debt of gratitude to the Federation of Insurance Institutes for encouraging papers dealing with Manufacturing Risks, and publishing them in their Journal, which now possesses a world-wide circulation.

I am doubtful whether these few notes are of sufficient merit to justify their inclusion in the Journal, but no labour of this kind can be performed altogether in vain, and they may be of service to myself and some of my brother Branch Managers in dealing with this class of Fire risk.

Some time ago I contributed a paper on Bedstead Works, and the figures published had some influence in improving rates and

the revision of such Insurances, with the advantage to some Offices of escaping subsequent losses.

If the effect of my short paper is to cause Confectionery Works to be more carefully examined, and, in view of the unfavourable experience, the rating thereof revised, I shall consider that I have not treated the subject in vain.

J. HEADON BOOCOCK,
DISTRICT MANAGER,
COMMERCIAL UNION ASS. CO., LTD.,
BIRMINGHAM.

Birmingham Insurance Institute,
May 2, 1902.

MANSION-HOUSES AS FIRE RISKS.

In attempting to deal with this subject, I must confess that at the outset I am somewhat perplexed as to the exact point of difference, or the definite distinction, between a Mansion-house and a Dwelling-house, either from a fire insurance or a general standpoint.

The terms "Mansion-house" and "Mansion" are usually taken, both in the fire insurance world and by "the man in the street" as synonymous, but in the dictionaries the Mansion-house and Mansion are separately defined, and their meanings are not given in identical phraseology. In an old dictionary I find a Mansion described as "the lord's house in a manor, a large house of residence," whilst in a new dictionary it is defined as "*any place of residence*, especially a house of considerable size and pretension, the house of the lord of the manor, a manor house." With regard to the meaning of Mansion-house, the old authority gives it as a "large house of residence," whilst the new one adheres to the comprehensive definition of "the house in which one resides, the inhabited house, a manor house."

Again, some of the dwellings publicly known as "Houses" are much larger than many of those styled "Mansions,"—for instance, Marlborough House, Chatsworth House, Clumber House, Holland House (Kensington); others are "Castles,"—viz., Arundel Castle, Belvoir Castle; whilst others are "Abbeys,—such as Welbeck Abbey, Battle Abbey, &c. Numerous large country residences, too, are known as "Halls." Others are known as "Courts," "Places," or "Palaces," and some in the Highlands are called "Shooting Boxes," and the London residences of gentlemen having country seats are verbally known as "Town Houses."

Modern use—if one may judge from the grandiose advertisements of the auctioneer who has the building for disposal—has reduced the meaning of the word "Mansion" to its representative value in £ s. d. Otherwise one could hardly imagine a Mansion

one of a terrace of mansions, or as belonging to anybody without territorial property or influence. For business purposes, or rather in connection with the subject under present consideration, the difficulties of technical definition must resolve themselves into one of monetary value, more especially with respect to the building itself, for it is to the building and its fixtures—comprising its heating and lighting arrangements—that one has to look in considering the risk involved. Undoubtedly the special character of the contents, if largely composed of breakable or perishable articles of artistic or historic value, has to be considered in fixing the retention on such a risk; but one would hardly treat a villa, or still more a small town-house, crammed full of *bric-à-brac*, as properly coming under the definition of a "Mansion," but rather as "a curiosity shop," where the limit of holding should be fixed with the eye well upon the "cabin'd, cribb'd, confined" character of the amount involved.

I therefore propose, for the purposes of this paper, to take £5000 in "bricks and mortar" as the minimum starting-point of a Mansion-house proper, with which alone I have to treat.

Construction. The majority of Mansion-houses are of first-class construction — *i.e.*, built of stone or brick and roofed with slate, tile, or lead. In several cases in Norfolk the fronts of the buildings are stuccoed or are faced with plaster or cement, or have the front external walls painted or distempered, probably for preservation, and possibly with the mistaken notion that it gives an ancient appearance to the building. All attempts at interference with the *natural* appearance only accentuate the fact desired to be hidden. This by the way.

A few are of second-class construction, having timber *in* their external walls, not to be confounded with ornamental timber-work *outside*, to give a *châlet* or rustic character to the building. Some still remain with thatched roofs—with notable instances in Norfolk and Lincolnshire—but Old Father Time has had, and will have, his heavy hand on these; and as they are of such a special character, they pass from consideration in this paper.

Many of the Mansion-houses now have conservatories or green-houses in communication and entered from the dining-room or drawing-room.

Lighting. Until the last decade, the country Mansion-houses were mostly lighted by oil lamps and by candles, and not a few are still lighted by the same means. With respect to mineral oil lamps, it is desirable that they should have metal containers and a heavy flat base. The quantity of oil kept in the Mansion-house itself should be limited to a day's consumption, the bulk being kept in a building —entirely detached if possible—quite away from the residence. City and suburban Mansion-houses are lighted by gas or by electricity—in some cases the gas or the electrical current being derived from the public mains. The gas meter should be in an accessible place, and the service-pipes should be provided with taps, so that the gas may be turned off at night from those rooms where it is known to be not required. Electricity generated upon the premises should in every case be subject to the approving report of a thoroughly qualified but not too faddy expert, for the systems so vary and present almost illimitable pitfalls of actual risk, that it is practically impossible to gather them up for avoidance in this paper. It may be taken for granted that when economy has been the ruling factor in the selection of the electrical contractor, the installation requires the utmost investigation. Many instances have come under one's cognisance where such installations, after investigation by the fire electrical expert, have to be entirely disallowed, and either a fresh contractor sought or the old one made to start *de novo*. When it is known that the Insured is about to have an electrical installation set up, he should be advised to see that his contract distinctly provides that before his contractor's bill is passed or paid it should be subject to the approval of the duly appointed electrical surveyor of a well established Fire Office.

Some of the country Mansion-houses—particularly in Ireland—are now lighted by coal gas manufactured on the premises, the gas-making plant being in the adjacent grounds, whilst others are lighted by gasoline, which illuminant is obtained from naphtha vapour mixed with air, the apparatus for which should be in a detached building, and not where the bulk of oil is stored. Acetylene gas, through its brilliancy of light and cheapness, is now being used in Mansion-houses, and if the generating plant be, in accordance with the regulations of the Fire Offices, in a building quite out of reach of the buildings insured, it is believed that no extra risk attaches. But this illuminant is quite in its

infancy, and has yet to stand the test of time before reliable data can be ascertained.

Heating. Ordinary fire-places and low-pressure hot water apparatus are generally used for warming Mansion-houses, the latter being also utilised for heating the conservatories or greenhouses referred to. Hot air apparatus is also in use to some extent, and it is not uncommon to find in the hall of the Mansion a pipe stove for warmth, and in this respect it is essential that the stove should be securely fixed and placed upon stone, and that the piping to any of the heating apparatus should be fixed 6 inches clear from any woodwork. The boiler or furnace for the hot water or hot air apparatus should be fixed in a sunk basement or cellar, entered from the outside only; in a modern Mansion-house the boiler-house or furnace-house is generally of fireproof construction.

Situation. For obvious reasons, the majority of Mansions are situated "far from the madding crowd," and are in comparatively isolated positions, some being built high upon the hills, where the contingency of a high wind at the time of a fire has to be considered, and others low down in the valleys, and as far as possible screened from public view by trees, walls, and fencing. Some even have high walls of masonry or brickwork quite around the park, extending for miles—in a case near Bristol, 10 feet high and 7 miles in extent. Others, as in London, stand in the public thoroughfares. Mansions in the old cities, where the city fathers loved to dwell, are fast disappearing, and with all their historic associations have been turned into clubs, hospitals, and even factories! Our own Head Office—formerly a mansion—has however been reserved for a better fate.

Some Country-houses have private laundries in communication, whilst with the better arranged they are detached. As these mostly partake of the character of large "wash-houses," it is perhaps hardly necessary to stipulate against the poling of linen or for the fixture of linen-horses, but it is essential that the arrangements should be the subject of enquiry, if not of inspection, and more particularly as to the protection, with wire guards and fenders, of the stoves.

Occupation. It is a lamentable fact that numerous country Mansion-houses are now, from agricultural depression and consequent reduction in revenue from farms, or other regrettable causes, no longer tenanted all the year by the owner; in fact, in Norfolk, an occupying landlord, notwithstanding the notable example and prestige of H.M. the King as such, is fast becoming a rarity. During the season for shooting, the Mansion or Hall is let furnished to some wealthy manufacturer or merchant, whilst the owner has to seek other and more modest quarters, and it is not uncommon for the winter occupier of the Mansion, or, as he is known, "the gentleman who hires the shooting," to be changed every year. This casual tenancy is a matter to be watched and considered, as a random tenant is not so keen to see that the chimneys are swept at fixed and proper intervals, nor is he particularly assiduous in seeing that the fire-extinguishing appliances—if any—are in working order, or that the inmates of the house—more particularly his servants, mostly London ones with "high" notions as to "demeanour" with the full capacities of that word—are taught and drilled in the most essential duty of a country household.* The hours when artificial light or heat are employed are then at their maximum, and big fires are sometimes left in the grates (when servants are too tired to exercise the rather doubtful alternative of raking them out), and are hastily abandoned to the evil genius of the fire fiend.

Rates. The general rate for the building of a first-class constructed Mansion-house is, I am afraid, settling down to 1s. 6d. per cent., although 2s. per cent. is at present sometimes obtained; indeed, in Ireland 3s. per cent. is occasionally secured. For the contents of a first-class mansion 2s. per cent. all round is often accepted, and the limit on pictures, if insured in one lump sum with the household effects, is sometimes extended up to 5 per cent. of the amount insured on such item, the higher valued pictures being the subject of separate and individual insurance, and exempted from the general insurance referred to, at 3s. 6d. or 4s. 6d. per cent.

In times past the following differential rates were sometimes charged if divisions were given in the amount, viz.:—

* *Vide* Appliances, pp. 125–8.

		Percentage.		
		1st Cl.	2nd Cl.	3rd Cl.
£	On Household Furniture, Linen, Wearing Apparel, and Wines and Liquors in private use, .	s. d. 1 6	s. d. 2 6	s. d. 5 0
£	On Plate and Plated Goods, Watches, Clocks, Trinkets, and Jewellery, ...	2 6	2 6	5 0
£	On Printed Books, ...	1 6	2 6	5 0
£	On China and Glass (including Looking-Glass Plates) and Earthenware, ...	4 6	4 6	5 0
£	On Prints and Pictures (with a limit of value, or as per Catalogue), ...	4 6	4 6	5 0
£	On Tapestry, as per Catalogue, .	4 6	4 6	5 0
£	On Musical and Philosophical Instruments, ...	2 6	2 6	5 0
£	On Fixtures and Fittings, . .	1 6	2 6	5 0

Nowadays, however, it is becoming the custom, as stated, to include all the articles, except valuable pictures and tapestry, in one sum at 2s. per cent. It is generally understood that billiard tables and bicycles, also guns, fishing tackle, and other sporting requisites, are included in the term "household furniture" without literal specification; but failing mention thereof, the wearing apparel and other personal effects of servants or visitors are not covered by such item. Tapestry should always be mentioned, although frequently omitted from the policy wording and its presence only evidenced by the claim for the loss thereon by fire. Statuary should also be specifically stated. If each piece of statuary or tapestry is not separately insured, a limit of value should always be inserted. It is not often that a separate amount is placed on jewellery, although in some instances it is of enormous value, as may be gathered from the press reports of the theft of the Marquis of Anglesey's jewels, as well as the adornment of his person in the part he plays in the Pantomime at the Castle—a new feature in Mansion-house risks—as well as of other burglaries at Mansions. The noted Castle at Craig-y-Nos has a special character for its theatrical performances, and, now that the King has set the fashion at Sandringham, such possibilities must not be ignored.

It has more than once been suggested that a Tariff should be formulated for the building and contents of Mansion-houses, but the difficulty of distinguishing between a Mansion-house and a Dwelling-house proved, it is whispered, one of the first stumbling-blocks in this connection. The real and true reason, however, for the non-issue of a Tariff for Mansion-houses is, I take it, that there is usually a large insurance upon the estate cottages, farm houses and farm buildings, &c., which would be jeopardised by any increase in the terms for the estate owner's Mansion-house. Therefore the Companies have been somewhat against or chary of having their hands tied in dealing with Mansion-houses, *per se*. Nor is there at present any tacit or honourable agreement existing between Offices in regard to the rates for this class of insurance, so that now, when quotations are asked, each Office quotes independently, and it is to be feared that, with a view to other contingent business, the terms named for the Mansion-house and Contents are cut very fine.

With regard to the policies, the value of the pictures is sometimes a vexed question to settle to the mutual satisfaction of Office and Insured. The market value of the picture immediately anterior to the fire, unless the picture be the work of some celebrated artist, is occasionally a difficult task to arrive at—market prices fluctuating according to fashion and demand. Some artists' paintings increase whilst others decrease in auction-room value. In the case, say, of a family portrait, painted by some little known artist, its value in the open market would not perhaps represent one-tenth of its value as an heirloom and from its family relationship to the Insured. It does not, to my mind, seem objectionable, even from an Office standpoint, that a valued catalogue of pictures should be given to and accepted by the Office at the time of the issue of the policy, such valuation being made, at the expense of the Insured, by a recognised firm of high respectability. This valuation has, I am aware, been accepted in some instances, and is, I think, better than the method of permitting the Insured to place upon the pictures fancy prices of his own creation, and the Office to then endeavour, when the loss occurs, to assess their values from an insurance viewpoint, to the disgust and irritation of the Insured, with the probable loss of the connection.* The foregoing remarks will also apply to valuable tapestry or statuary.

* *Vide* Fire Losses, pp. 130-1.

It must be clearly understood, however, that my comments with regard to this valuation apply only to the pictures, tapestry, and statuary. For other articles of household furniture it would, from the introduction of new goods, removal of old, wear and tear, and depreciation, be necessary to have an inventory made at least yearly—which would be a serious annual expense to the Insured—so that, in the event of loss, the Insured could be properly and fully covered under his general valued policy. For if a valued policy for all the effects were issued, only the articles mentioned in the inventory, which were actually in the house at the time of the fire, would be paid for, the other articles introduced since the inventory was made being considered uninsured. Therefore, if the valued policy and the inventory had been in force say ten years, the Insured would probably be a heavy loser in the event of the entire destruction of his household effects. Consequently it is better for the Insured, outside the question of the value of the pictures, tapestry, and statuary, to effect his insurance under the ordinary conditions, which only require "as particular an account as may be reasonably practicable of the several articles and things damaged or destroyed, with the estimated value of each of them respectively, at the time of the loss or damage." Upon some policies the following Memo. is now added, in connection with the item on general contents. This was launched by Offices offering special advantages to private insurers, and has been adopted by other Offices for protection's sake, and to prevent their clients being lured away from them by such inducements.

MEMO.—It is hereby declared that the property to the extent of one-tenth of the sum insured is covered whilst the same is temporarily removed by the assured to and is contained in any one private dwelling-house, boarding-house or hotel in the United Kingdom (hotels in Ireland and in Glasgow, Paisley, and their suburbs excepted) at which the assured may be visiting or staying, and in like manner house linen and wearing apparel shall to the extent of one-twentieth of such sum insured be covered whilst temporarily at any private or public laundry in the United Kingdom, and plate and watches, jewellery and trinkets also to the extent of one-twentieth is covered whilst temporarily deposited at any bank in the United Kingdom.

It is further understood that this policy extends to cover household furniture and personal effects of visitors and servants.

The Memo. does not, it will be observed, stipulate that the

sum insured on the general contents of the Mansion-house shall temporarily stand proportionately reduced. Consequently in the event of the total destruction of the Mansion-house, although portions of the effects were contained and covered elsewhere, the full sum insured would possibly be claimed.

Appliances. Comparatively few of the country Mansion-houses have at the present time any appliances ready at hand for the extinction of fire. In most cases, when an outbreak occurs, a horseman or bicyclist has to be despatched to the nearest fire brigade station, and it is often upwards of an hour before the fire engine—sometimes only a manual one—appears upon the scene. In some instances water is only obtainable from pumps, pits, or ponds, but some Mansion-houses have lakes or ornamental sheets of water adjacent thereto. By the time the fire brigade gets into work, the fire has often got good hold, and when endeavours have been made to save the family plate, pictures, &c., the Mansion-house has virtually to be left to burn itself out.

Not infrequently, where fire appliances *have* been provided by the landlord, the temporary tenant's servants are unaware of their existence or whereabouts, or do not know how to use them. To bear out this statement, I could specify an instance of a fire which occurred in a Mansion-house during the occupation of one of these occasional tenants, and where, although there were hose and other appliances, the tenant's servants were entirely ignorant of their presence or use, and consequently the appliances were not utilised, but were actually destroyed with the Mansion-house. I will quote another case from an excellent pamphlet on "Periodical Fire Inspection and Drill," published by the firm of Merryweather & Sons, London. In this instance it was the Wiltshire Mansion, Clouds House, the residence of a gentleman well known in the political world. Here a hydrant system had been installed, with hose and other appliances; but when the fire broke out the hydrants were found to be frozen, the appliances were mislaid, and general confusion reigned. No one knew what to do, and the fine house (with its splendid furniture and articles of vertu) was soon a wreck.

Upon a few estates, however, a steam or manual fire engine, with hose, &c., is provided, and the servants, gardeners, and other employés are made acquainted with the use of the appli-

ances. In this connection I call to mind a newly erected Mansion-house standing on the descent of a hill. Here there is a reservoir (holding 20,000 gallons) on the roof of a building on the top of the hill, fed from wells by means of a steam pump, which also supplies the tanks (holding 2000 gallons) on the roof of the Mansion-house. There are four hydrants round the Mansion, with 3-inch, 4-inch, and 5-inch mains (supplied from the reservoir), "and hose sufficient to command the premises," and there is also a fire brigade of employés, of not less than twelve men, regularly drilled. A steam fire engine is unnecessary, as the pressure from the mains is sufficient to throw the water over the roof of the Mansion-house. Besides, there is a lake (of 2 acres in extent) about 200 yards from the residence, a fire brigade station 5 miles distant and two others 8 miles distant, and the Insured's own couplings are made to be identical with those of the nearest fire brigade.

Instead of making any suggestions of my own with regard to the fire protection of Mansions, and the periodical inspection of the appliances, also the drilling of the private brigade by a competent person, I think it better to make use of the following extracts from Messrs. Merryweather's publication, with regard to the use of the simple appliances—fire buckets and hand pumps:—

"Buckets of water should be hung in convenient positions in every house. They should be kept full of water ready for use in case of fire. But this is not all. In very few buildings is the water supply so arranged that, in whatever part a fire may occur, the buckets can be replenished as fast as required without passing through several hands. Then it has to be remembered that a couple of gallons of water (the capacity of a full-sized fire bucket) thrown on the fire in a powerful jet is ten times more effective for extinguishing the flames than when thrown direct from a bucket, therefore one or more portable hand fire pumps (the 'London Brigade' hand pump is very suitable) should be provided, and the buckets used to replenish the cistern of same as required. We have, therefore, invented a simple drill for buckets and hand pumps, which is carried out as follows by our Inspectors:—

"The alarm of fire being given, the house brigade assemble at an agreed point, each bringing a bucket of water (the buckets are kept hung on rails in the passages). The position of the supposed fire having been stated by the Inspector, and the water supply,

preferably from the bathroom, where the bath can be kept filled, known, the Inspector calls 'Attention,' and all line up and 'prove distance.' 'Proving distance' is done by each person stepping away from the next, either to right or left, according to position of water supply, and extending an arm to just touch the shoulder of the next person, this distance being the best for passing the buckets quickly along. Of course, where the number at drill is few, and a long distance has to be covered from water to pump, this distance has to be increased proportionately. The distance having been 'proved,' the person nearest the water supply passes his bucket (filled) to the next in the line, keeping the bucket close to the body. The bucket is kept close to the body so as to preserve the balance, and as soon as one bucket has gone up the line and been emptied into the pump cistern, it is passed back down the line, being taken past the full buckets on the outside. By this arrangement there can be no confusion or sending of empty buckets back to the pump or full ones to the water, and after a few practices the celerity with which the water supply is kept up to the pump is surprising. Of course, when two or more pumps can be supplied, a double line of persons can be formed to pass the full and empty buckets along. The use of a hand fire pump in this manner renders it for a small fire as effective as a hydrant, the jet being steady, while the damage by water is much less.

"The good work which can be done with a hand pump was proved at the fire at Lambeth Palace, on 5th December 1897, when an alarming outbreak was put out by one of these appliances and the Palace saved.

"In order to maintain the efficiency of a private brigade, nothing is more effective than frequent periodical drills by the resident fire brigade. The servants whose duty it would be to work the appliances should be exercised at least once a month in their manipulation, by the steward, butler, or other servant who has been constituted the head of the 'household brigade.' This will ensure everything being in its place and in good order; the drill would be as effective as a real fire in bringing to light any hidden negligence or accident. Fire drill is as easy and simple as a drill of any sort can possibly be, and an hour's practice every month should make every servant proficient.

"The best check against that negligence and want of caution on the part even of our private brigade, which long immunity

from disaster may occasion, I hold to be a periodical inspection and drill by some person not connected with the estate, preferentially by the fire engineer by whom the appliances were made. He should go most minutely over the fire gear, and make himself personally acquainted with every man who has to handle it, and after every such inspection a written report should be furnished to the owner direct, or to the agent of the estate. The expense of these visits is infinitesimal; their value, on the other hand, is very great; they insure the maintenance of the whole machinery in its first condition, and prevent the annoyance which must be felt if good and expensive apparatus should fail, because, after years of idleness, it is found wanting in some small but essential particular when the necessity for its use arises.

"As an instance of the good results achieved, we may mention the fire which occurred a few years ago at the residence of the Duke of Marlborough. At Blenheim Palace a Merryweather steam fire engine is kept ready for use and a private fire brigade is maintained, the whole being inspected periodically by us. When the fire broke out, the alarm was given, and the steamer got to work with such good effect that the fire, which had got a good hold, was extinguished. It was a 'good stop,' *the damage being covered by a few pounds, while the property at risk has been valued at over a million sterling.*"

It is but little, however, that the Insurance Companies can now offer the Insured in the shape of discount off the premium to tempt him to incur the expense of obtaining adequate fire appliances and of periodically summoning his men and taking them from their normal avocations to practise firemen's duties or to be drilled by an expert. For, as I have said, the terms have usually been already brought down so low, that it is almost impossible to grant any substantial or adequate rebate; indeed, off the building rate, if 1s. 6d. per cent. be the figure hitherto obtained, nothing can of course be deducted. And even if the steam fire engine and hose were also available for use in other portions of the estate, the Farming Property Tariffs do not permit of any discount being made in connection with the rates for the farm buildings, &c. But Mansion-houses with their contents are not generally insured for anything approaching their real value, so that, when a total loss occurs, the owner is frequently himself a heavy sufferer. Fire appliances are, therefore, in this connection, worth their cost and maintenance, as well as

in the protection of life and limb. The following, from the "Review," illustrates the latter point:—

"A Country House Destroyed: Loss of Life.—General Charles Dumbleton's residence, Midlington House, Droxford, Bishop's Waltham, Hants, was destroyed by fire early on Sunday week, and two of the servants lost their lives. The damage is estimated to amount to £17,000. There was a scarcity of water, and the Bishop's Waltham brigade were unable to render assistance in consequence. When the servants were missed, many efforts were made by the police and villagers to reach them, but unsuccessfully."

Fire Losses. Although many fires have occurred, and the losses have in numerous cases been serious, this class of business does not appear to have been altogether unprofitable to the Insurance Offices. Defective flues, with timber beams projecting into or running across the chimneys, have been the cause of several of the older Mansions being destroyed. The overheating of the warming apparatus, or of the apparatus being in contact with woodwork, has led to heavy claims. Birds' nests in chimneys have occasioned fires, and boarded-up or disused chimneys have led to claims. Workmen being employed upon the roof or elsewhere upon the Mansion-house has also resulted in fires. Not long since a case came before me in which there was a stove in the hall of the Mansion-house, with pipe led horizontally along the inner wall, about 3 feet from the ceiling, through the external brick wall (at rear) into the open air, and thence up to the eaves of the roof. This arrangement the Office considered perfectly safe, but the owner and his architect pronounced it unsightly. The pipe was therefore removed from its old position and carried up a chimney adjacent to the stove. Shortly afterwards, as the household were retiring to bed, smoke was found issuing from the flooring adjoining the chimney on the second storey. The estate carpenter and other tradesmen, luckily living handily, were hastily summoned, and upon pulling up the flooring, and knocking out the brickwork, it was found that the iron flue was in contact with an old projecting wooden beam and had set the same alight. The loss was settled for about £10, but, failing the early detection of the fire, the loss might have been a total one (of upwards of £25,000), as there were no fire appliances at the residence, which was eight miles from the nearest fire brigade station.

I will give now brief particulars of a few recent fires, viz.:—

Insurances. Buildings and for Contents.	Approximate Loss.	Cause of Fire.
£34,000	£14,700	Defect in flue.
34,425	18,600	Stove in nursery.
22,680	7,000	Smoking in chapel.
82,650	17,600	Ignition of wooden meat-screen in kitchen.
39,600	38,000	Electric wire fusing.
31,560	2,400	Defective flue.
	2,400	Defective flue.
12,700	54	Paraffin lamp.
20,000	30	Ignition of beam in chimney.
32,000	60	Foul flue.
45,000	65	Airing linen.
12,000	750	Paraffin lamp.
9,350	10	Sparks from grate.
13,200	1,750	Unknown.
	3,500	Defective flue.
	180	Sparks from grate.

It will be seen that in the foregoing list defective flues or chimneys predominate as the cause of fires, and in this respect the above statement may, I think, be fairly taken as indicating the starting-point of the majority of Mansion-house fires. Speaking generally, it may be said that losses in connection with Mansion-houses are either small or relatively considerable, and that, owing to the absence or inefficiency of extinguishing appliances, unless the progress of the fire is early arrested, it will entirely destroy the whole of a small Mansion-house or a great part of a large one. To mention, by the way, a novel cause of fire in respect of this class of risk, I recently observed, from the columns of the "Daily Mail," that an old Mansion (in Gloucestershire), which had been unoccupied for some years, had just been destroyed by fire, and the conflagration was supposed to have resulted from a fire having been left burning by a tramp who had slept there the previous evening.

With regard to the settlement of claims, I will only trouble you with some details concerning a loss upon pictures. In this case, the Assessor came to a picture upon which £5000 was insured,

and which was slightly damaged; that is, the head of one of the several figures painted thereon was obliterated or damaged by fire or smoke. The claimant or his adviser stated that, as the celebrated artist who had painted the picture was dead, the picture was ruined, and therefore the full amount insured thereon was demanded. To this the Assessor at once agreed, but claimed the "ruined" picture as salvage, saying that of course he could not allow the Insured the whole of the £5000 insured upon the picture and still permit him to retain the latter. The claimant, or his adviser, knowing that the picture, even in its damaged condition, was worth more than the £5000 claimed, and that the Office would therefore more than recoup itself if the £5000 were paid, at once "changed front," and agreed that the damaged portion should be reinstated or repainted by one of the best living artists, at the expense of the Office—of course for less than £5000—and that the picture should remain in the possession of the Insured.

It would of course have been quite open to the Insured to claim the total amount insured as being the loss or depreciation caused by the fire (or smoke), the picture remaining his property. In that event the sum payable must have been ascertained by experts mutually chosen. The question of partial loss has thus a most important bearing on "valued" picture-items of policies—as well as on other "valued" items, should such be granted.

Limits. The amounts retained by the various Offices upon this class of risk vary somewhat—some taking £3000 as the limit for a country Mansion, while others keep up to £6000 or £7000. Upon London Mansions it is not, however, uncommon to find that £10,000 or up to £15,000 is kept by Offices, at their own risk.

In arriving at a decision as to retention, some are now guided to a great extent by the replies to the following, or somewhat similar, enquiries upon a "Mansion Form":—

Queries relating to Mansions.

1. With what materials is the Mansion built and roofed?
2. What is the age of the Mansion?
3. Does it stand on an eminence?
4. How is the building lighted?
   (*a*) If by mineral oil lamps, state if such lamps have a heavy flat base.

(*b*) State where the oil is kept.

(*c*) The average quantity of oil kept at any one time.

(*d*) If by gas, state if the service pipes are provided with taps, so that the gas may be turned off at night from those rooms where it is known to be not required.

5. How is the building heated?

(*a*) If by hot air apparatus, give some particulars of the arrangements.

(*b*) If by hot water apparatus, state whether high or low pressure.

(*c*) Where is the furnace placed?

(*d*) Is there any timber built into or near the fireplace or flues?

(*e*) Are the chimneys swept at fixed periods?

6. What are the fire-extinguishing appliances upon the premises, and where kept?

7. Is there hose sufficient to command the premises?

8. What is the nature and extent of the water supply, and how far is it distant from the Mansion?

9. State the distance of the nearest fire brigade station to the Mansion.

10. What proportion does the Amount Insured on Buildings and/or Contents bear to their respective value?

11. Is any other Office interested in the Insurance?

(*a*) If so, state the name of the Office or Offices, and give amounts of such Insurances.

Fire Prevention and Extinction.

A document advising the adoption of the following simple precautions and recommendations might with advantage, I think, accompany the "Mansion Form," and be handed to the Insured by the Agent:—

Make it a rule to have all chimneys swept regularly, and if one catches fire, throw on common salt, and fasten a wet blanket immediately to the top of the mantelpiece, so as to exclude all draughts from the opening of the chimney, and entirely cover the grate, shutting the register trap if possible.

Never use benzoline or spirit lamps for domestic purposes.

Never use mineral oil lamps with china or glass oil cisterns, but always use those with metal cisterns and those constructed on the Safety principle, which are self-extinguishing when upset. If

other than Safety lamps are used, in extinguishing them do not blow down the chimney in putting out the light. Let the lamps be cleaned and filled every day, and insist on having this done by daylight only. The best substance to extinguish burning mineral oil is sand or garden mould; water often tends to spread the burning oil. If sand is not available, a blanket thrown over the spot will often extinguish the flame by excluding the air.

Avoid drying or airing linen in ovens or on the plate racks.

If hanging curtains catch fire, tear them down at once. Rolling blinds can often be extinguished by rolling them up sharply.

Smoking in bed or reading in bed by artificial light should never be indulged in.

Gas burners should be fixed free from woodwork, blinds, or anything inflammable, bracket burners be properly stopped, and the flame in all cases protected by glass.

I must now conclude my paper, written, as you are aware, at but short notice, and would express the hope that, in my endeavour to deal with the matter practically and pointedly, I have to some degree been successful. Pray pardon all shortcomings, and of your mercy take the will for the deed.

C. R. QUINTON.

Norwich Insurance Institute,
January 1902.

SAW MILLS AND WORKERS IN WOOD.

THE subject of the present paper relates to a class of risk of the utmost importance to Fire Insurance officials, and which includes some of the most hazardous premises we have to deal with. It therefore deserves our most careful attention, and I should have been glad if your Council had entrusted the matter to more able hands. I do not, however, expect to enlighten those members of our Institute whose duties call them to survey this kind of risk, but rather seek to convey to the minds of those gentlemen who have no opportunities of seeing for themselves some idea of the processes carried on, and the attendant hazards.

There are so many kinds of Woodworkers that it would be difficult to deal with all in the limits of a paper; but I propose to touch upon:—

Saw Mills.
Joiners' and Builders' Workshops.
Cabinetmakers.
Woodturners.
Boxmakers.
Coachbuilders and Wheelwrights.

We must make a distinction between risks where power is used and those where hand work only is done.

SAW MILLS.

Saw Mills proper consist of buildings where sawing, planing, moulding, and allied processes in connection with woodworking are carried on; and we often find in conjunction therewith the manufacture of builders' joinery, such as doors and window frames. The chief points to keep in view are Construction, Nature of Processes, Lighting, Heating, Driving Power, and Situation of the Boiler and Stokehole (if steam used), Position of Shafting, Lubrication of the Bearings, Storage of Lubricating and Burning Oils, Appliances, Water Supply, and Distance from nearest Fire Brigade.

Construction. We do not find this to be of a substantial character, except in a few cases; and in view of the nature of the processes carried on, and inflammability of the materials used, this is much to be regretted. The hazard demands buildings of the most solid construction, and yet we find a large number of saw mills built wholly or partly of timber, while fireproof structures are almost unknown. Timber buildings are never desirable, owing to their liability to attack from without, especially on unguarded premises; and when, in addition, we have the necessarily heavy risk of a saw mill within, they become, if not uninsurable, of such a speculative character that it is best to leave them severely alone. For politic reasons we have, however, occasionally to accept insurances on them.

Corrugated iron structures have a somewhat greater immunity from outside attack than wooden buildings, but otherwise are equally unsubstantial.

The brick buildings usually met with are not so well constructed as we might wish, and it is seldom we find anything but the ordinary wood floors, with openings in many places for shafting or belting, or to pass the refuse from the machines; unless it be in the basement, or, in the absence of the latter, the ground floor, where we may find earth, brick, or concrete. In premises where joiners are employed, the workshops occupied by them usually have at least one side with a large amount of timber and glass.

Processes. These vary so much that, although most of the risks possess features in common, it can safely be said no two cases are alike. Briefly, some or all of the following work is carried on:—

Sawing.
Planing.
Moulding.
Grooving, Tongueing, and Rebating.
Mortising and Boring.
Tenoning.
Turning.

In order that these processes may be better understood, I have obtained illustrations of various machines employed in woodworking; but before we glance at them, it may not be out of

place to explain the terms used for describing various pieces of timber. Planks are timbers 3, 4, 5, and 6 inches thick; Boards, 2 inches thick and under; Deals, 3, 4, 5, and 6 inches thick, and 7 to 13 inches wide; Scantlings, 2 to 6 inches square; Battens, 2½ inches thick, and 7 inches and over wide; Flitches are timbers such as used in beams constructed of two or more pieces bolted together. What we know as slate laths are often called slate battens.

We now pass on to the machinery, and perhaps the best known is the Circular Saw, of which Fig. 1 illustrates a class known as Rack Saws. These are used for cutting up heavy logs into planks, scantlings, and the like. Fixed nearly on the ground-level is a double table, working one part on each side of the saw by means of a rack and pinion, which carries the log to the saw. Rollers are usually fixed at either end of this table for convenience in shifting timber on or off the latter. These saws are often geared below the floor on which they work.

More common than the Rack Saw is the Circular Saw Bench shown in Fig. 2, which is suitable either for ripping small logs, deals, scantlings, &c., or for cross-cutting the same. The timber is usually, on benches of this description, pushed by hand past the saws; but fluted rollers, worked by power, and pressed against the wood by a lever, sometimes constitute the feed. In other cases we find a chain or rope, working round a drum or drums, used. The fence shown at the back of the saw is movable, and the timber is held against it to regulate the size of the cut.

The Pendulum Saw (Fig. 3), a circular saw worked at the end of a swinging frame, is used for cross-cutting, and is generally fixed over a bench.

Horizontal Saws, working either a single or pair of blades, are suitable for cutting boards from logs. The logs are usually carried through the machine in a similar manner to that already described in connection with the Rack Saw. There is a device for raising or lowering the height of these saws.

Upright or Frame Saws are machines in which a variable number of saws, as may be required, can be fixed in a frame driven up and down by means of a crank shaft fixed at the base of the machine. The heavier ones, called Log Frames (Fig. 4), are adapted for sawing up logs, and those of lighter construction (Fig. 5) for converting deals, &c., into boards, and are known as Deal Frames.

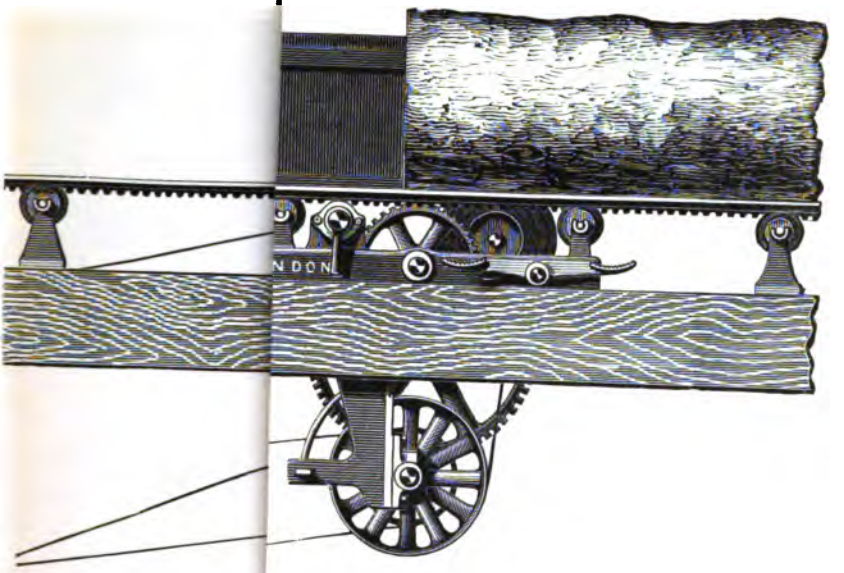
I should like to draw your attention to this class of machine, which is geared below the level of the floor on which it works, and requires a deep excavation for its foundations, pulleys, crank shaft, and swing frame. The consequence of this is that, no matter how careful the saw-miller may be in fixing the loose boards which are the usual means adopted to divert the dust from the base of the machine, space must be left for the crank shaft to work in, and the bearings therefore become covered with the dust. This helps to soak up the oil used for lubrication, rendering the bearings liable to get over-heated, and as at the same time there will probably be an accumulation of dust on which oil from the bearings has been dripping, we get very favourable conditions for spontaneous combustion, more especially if the dust be sawn from wet timber. This is, however, entirely obviated by a method adopted in a mill I had the privilege of seeing a few days ago, where the dust is caught by means of a wood slide made of tongued and grooved boards attached to the ceiling of the basement. In the middle of the slide is a wood shaft, sufficiently large for the crank shaft to work in, and attached to the latter, as well as to the top of the wood shaft, is a piece of bunting with sufficient play to allow for the motion of the machine, which prevents the dust from getting to the foundations of the frame.

In most workshops we meet with Band Saws, but not often with those of the larger type such as Fig. 6, which are suitable for board cutting from the log. You will notice that the bottom pulley round which the saw works requires an excavation to rotate in.

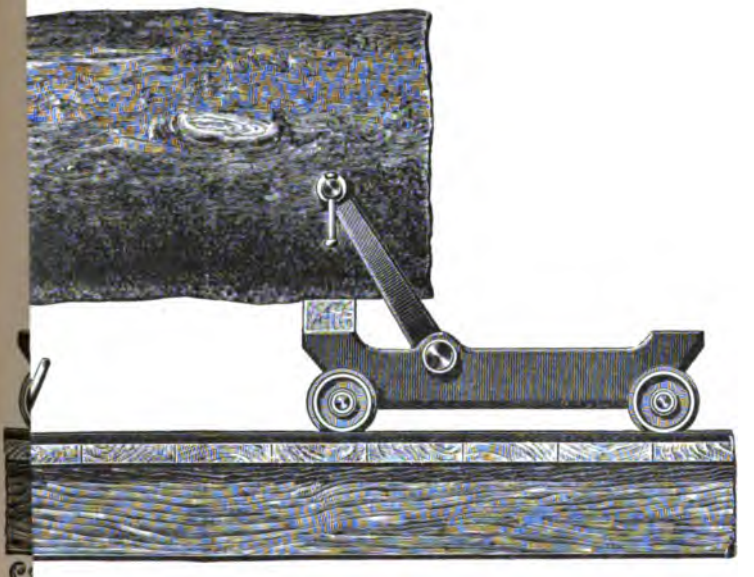
Horizontal Band Saws are not common, but, being wholly fixed above the floor level, the refuse must necessarily be removed at frequent intervals. Fig. 7 shows this machine, which runs at a very high speed, the saw travelling 7000 feet per minute; such machines are, therefore, capable of doing a larger amount of work than either the Horizontal or Frame Saws. The casting which carries the saw pulleys is capable of being raised or lowered to suit the cut required, so that when once the log is placed on the carriage it is not necessary to shift it until wholly converted. The Band Saw usually met with is of the class shown in Fig. 8, and it is suitable for cutting timber in sweeps and curves.

The Jigger Saw is a Fret Saw driven by power.

The Horizontal Cross Cut Saw of the type shown in Fig. 9 is not in general use, but we meet with it occasionally.



LING TABLE.



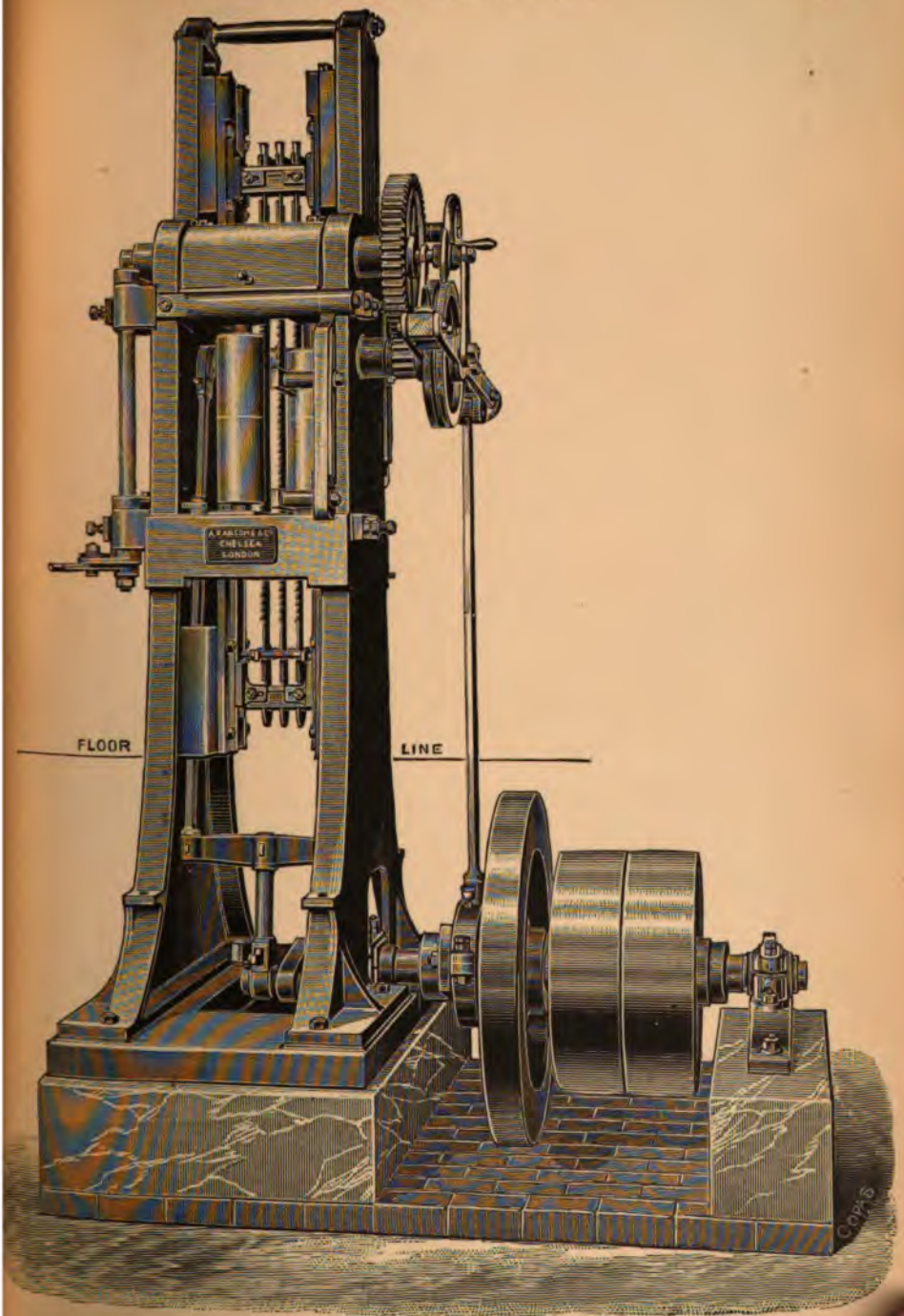
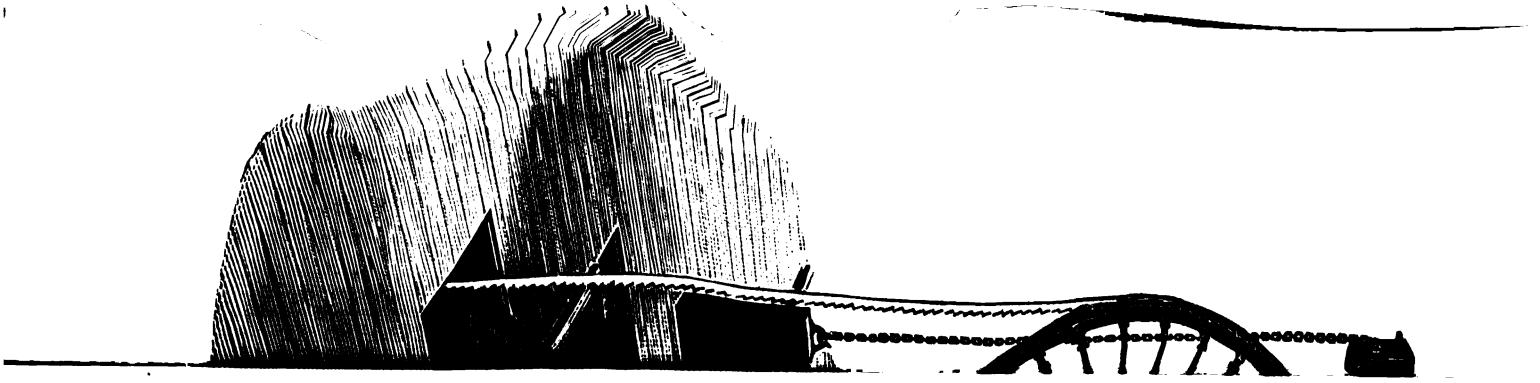
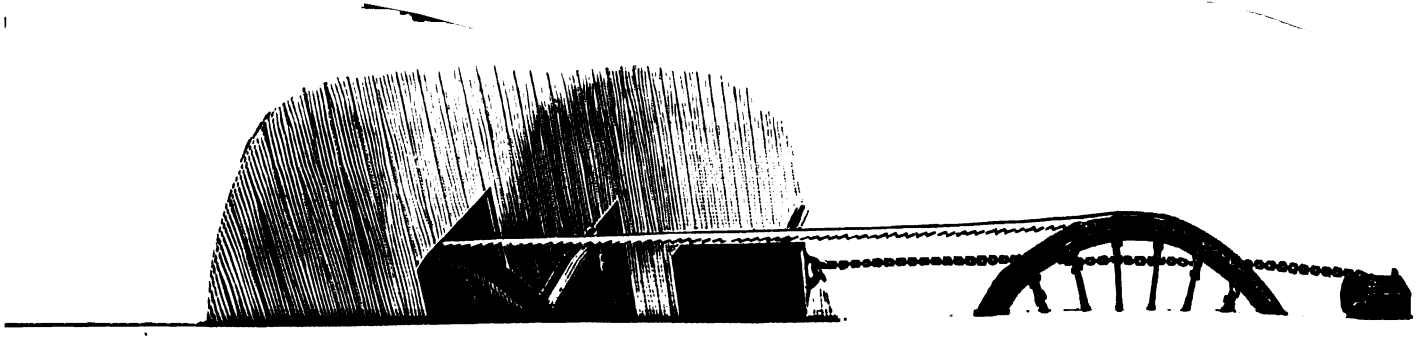


Fig. 5.—Single Deal Frame.





Planing.

There are many kinds of Planing Machines, Fig. 10, which is a Flooring and Matchboarding Machine capable of preparing floorboards, being one of the most elaborate, the boards being planed, grooved, tongued, edged, and thicknessed in one operation, at a speed varying from 120 to 150 feet per minute. I may say that "edged" means having planed edges, and "thicknessed," reduced to a perfectly uniform thickness. Looking from right to left of the machine you will notice two pairs of fluted rollers, constituting the first part of the feed. These draw in the timber and pass it over the bottom revolving cutter, which removes any irregularities on the

Fig. 7.—Horizontal Band Saw.

under side; from thence over a pair of fixed knives, through two more pairs of rollers, on to the revolving side cutters, which form the grooves and tongues and plane the edges; and lastly, under the top revolving cutter, which thicknesses them. Another bottom cutter at the end of the machine may be used for forming a beading on matchboarding, and two fixed side knives for imparting a smooth finish to the edges. The apparatus on the top of the machine is for pressing down the boards when passing over the knives.

These machines are not often met with, at least in this district,

as most of the flooring and matchboarding is prepared abroad before being shipped. The illustration serves, however, to show what a Planing Machine is capable of doing.

It may be here stated that the revolving cutters of a Planing Machine make a very large quantity of chippings, and the fixed knives produce shavings of probably the entire length of the board dealt with. If the machine, which stands entirely on the floor level, were worked by overhead shafting, and had no opening into a vault beneath, it would, of course, be necessary to constantly remove the waste; but such machines are frequently operated from beneath, and necessitate openings in the floor to admit the refuse being discharged into a basement.

Fig. 11 shows a Panel Planing and Thicknessing Machine, which we are more likely to meet with. These machines can be fitted with side spindles to plane the edges of stuff, but usually have a top cutter block only. The table is raised or lowered to suit the thickness of the material worked.

Trying-up, or strictly, Trueing, Machines (Fig. 12) are planers having a top cutter block which has a considerable vertical range to enable it to be set for dealing with thin boards or pieces of timber of considerable thickness. The wood is carried under the cutter block on a planed iron table, running perfectly level, and is thus planed and trued up.

The Surface Planer has two cutter blocks, one above and one below the table.

Many small Planers are fed by hand, the timber, sliding against a fence, being pressed down, and at the same time pushed over the cutters.

Grooving, Tongueing, and Rebating.

It is unnecessary, I think, to explain what grooves and tongues are, but a rebate, or rabbet, may be said to be a rectangular groove cut in the edge of a piece of timber. The back of picture moulding is, for instance, rebated to hold in the glass, &c.

Grooves and rebates are sometimes cut by means of the Circular Saw; and we have seen that the Planer will groove and tongue. It will also make rebates.

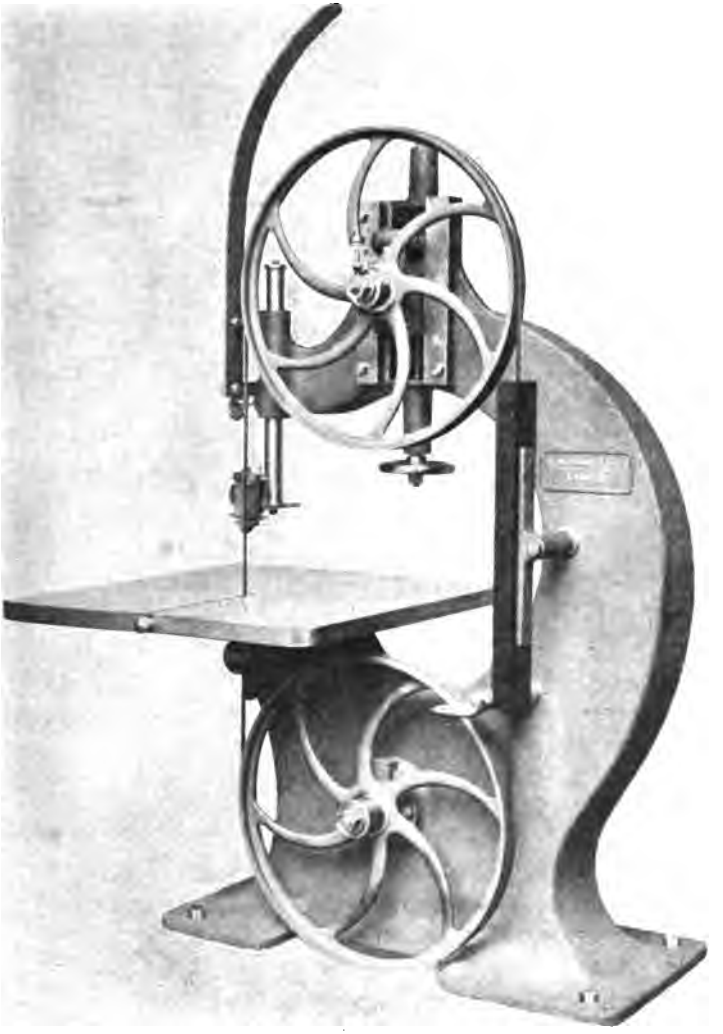
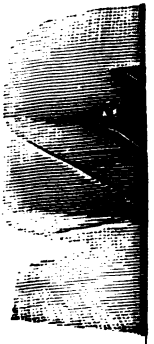
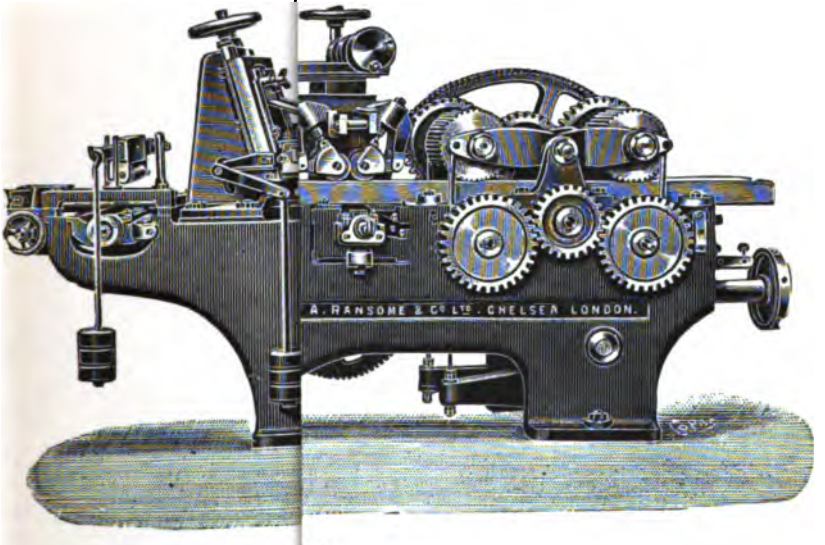
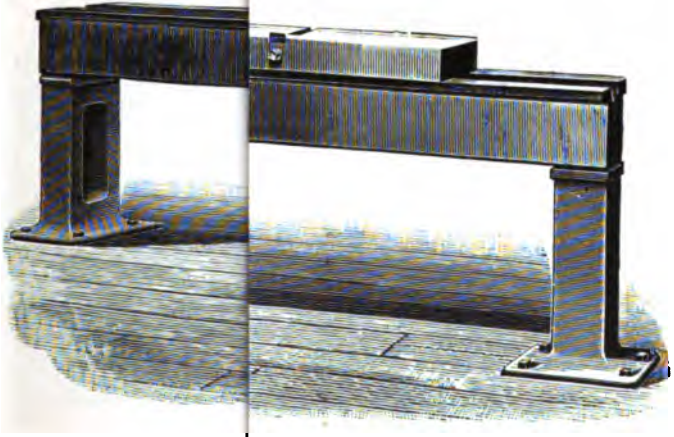


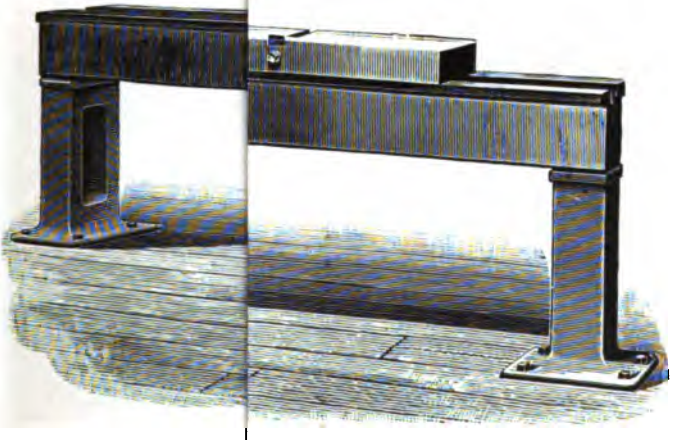
Fig. 8.—Plain Band Saw.

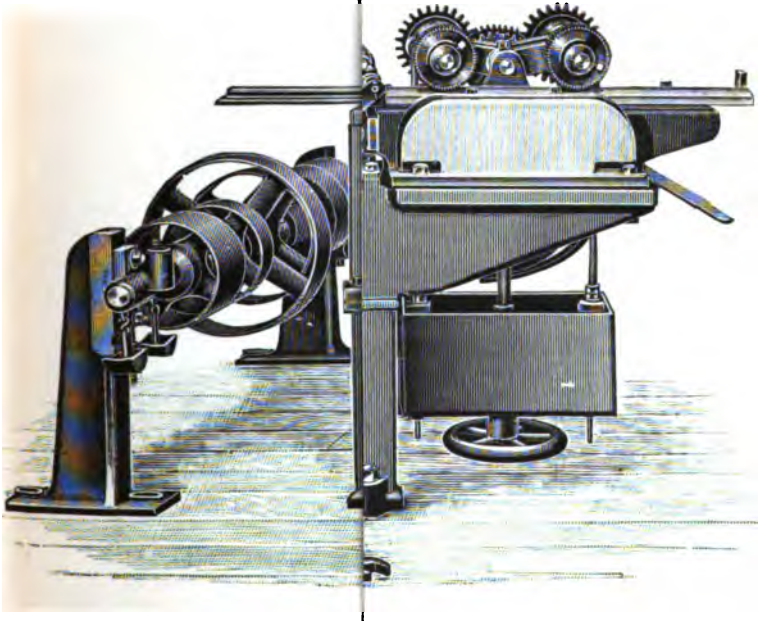




HINE.







Moulding. The large Moulding Machines (Fig. 13) are on much the same principle as the heavier class of Planer, but the knives on the cutter blocks are suitably shaped and adjusted to cut the necessary curves and angles. The speed of the cutters is 3000 to 4000 revolutions per minute. Vertical Spindles are Moulding Machines used for moulding, rebating, or shaping pieces of wood of curved or irregular form. Fig. 14 is a Single Spindle.

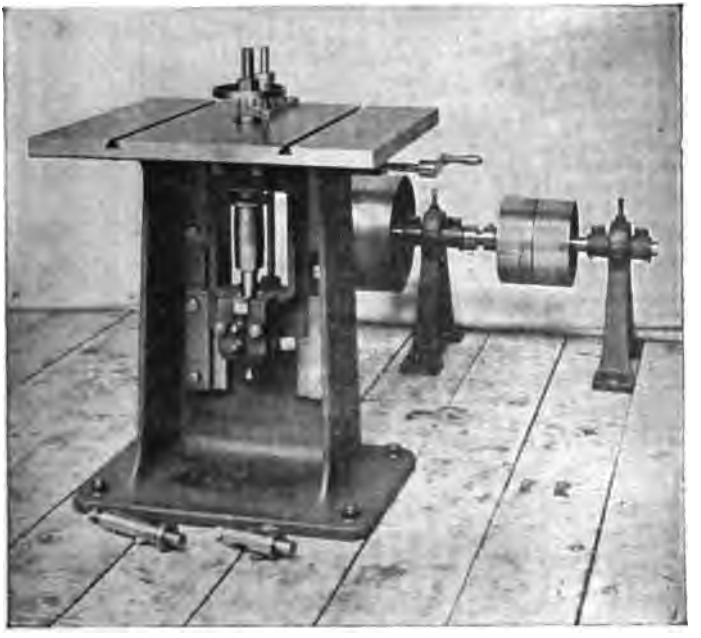


Fig. 14.—Single Spindle Irregular Moulding Machine.

Mortising and Boring. A mortise, as doubtless we are all aware, is a hole cut in or through one piece of timber to receive a corresponding projection, called a tenon, in another. In small joiners' shops a Hand Mortising Machine is used, but in the larger works the Steam Mortising Machine (Fig. 15) is adopted, in which the chisel is driven by power. A Boring Spindle is also shown on the last mentioned machine; but separate machines are frequently used for this purpose, sometimes with the tool working horizontally.

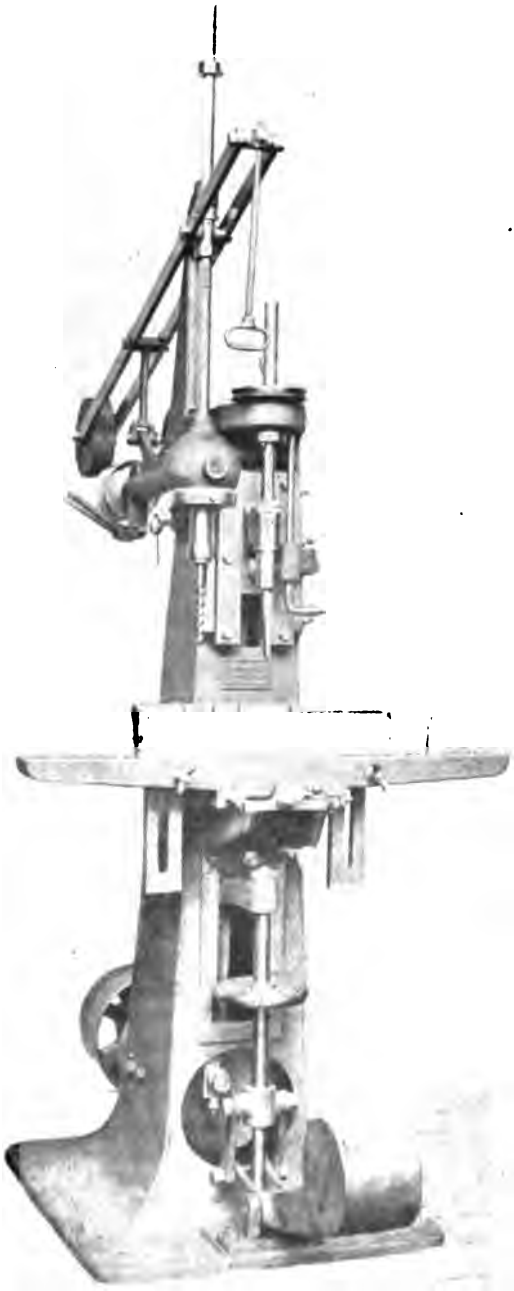


Fig. 15.—High-Speed Joiners' Mortising Machine.

Tenoning. Tenons may be cut in various ways, and Circular Saws are often used for the purpose; but probably the best class of machine is that shown in Fig. 16. These are provided with two horizontal cutter spindles, one working on either side of the timber, which is secured to a sliding table carrying it between the cutters. An upright spindle carrying a drunken saw for cutting double tenons can be used with this machine.

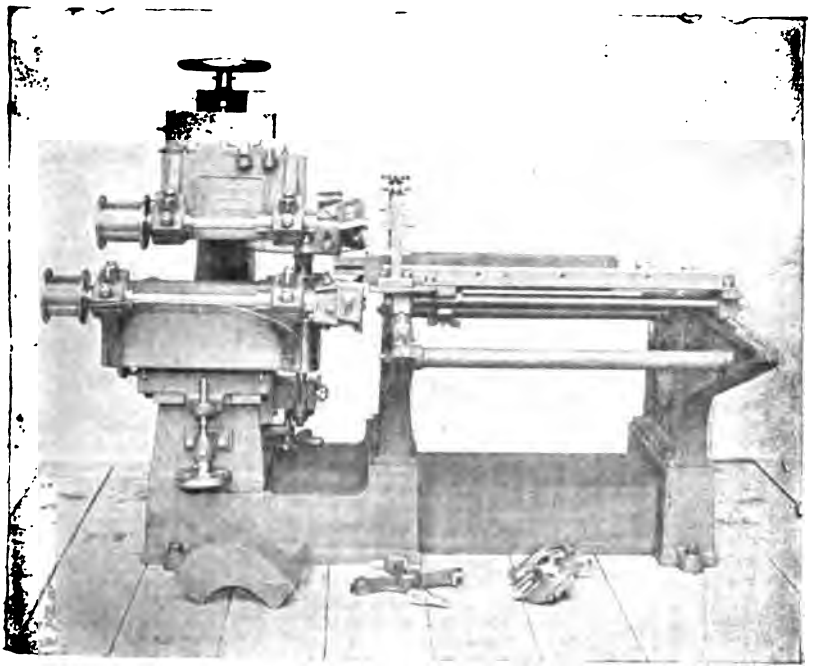


Fig. 16.—Tenoning Machine for Joiners' and Cabinetmakers' Work.

Turning. Lathes are, of course, used for this class of work, and generally there are several in a saw mill, but they are mostly used by wood-turners. Fig. 17 is a Plain Wood Lathe. The wood to be turned is placed between two points, one of which, called the front centre, is driven, thus causing the timber to revolve; and the workman, steadying his tool on the rest shown in the bed, applies it to the wood. Overhanging the bed of the Lathe to the left is what is

known as a face plate, likewise driven, on which such articles to be turned as table tops are fixed. The rest used in connection with this is fixed on a stand.

General Joiner.

We must notice this machine, which, as its name implies, is used for a variety of processes. That shown in Fig. 18, being of a more versatile character than those usually met with, will rip, cross-cut, plane, mould, groove, tongue, tenon, mortise, and bore. It is a machine suitable for a builder's workshop, where the demand for one class of work would not exist, as in saw mills working for the trade.

Saw Sharpeners, &c.

In addition to the machines used for woodworking, we find in all saw mills grindstones and emery wheels of various descriptions driven by power for tool and saw sharpening. These give off showers of sparks whilst in use, and although that looks hazardous, the particles of metal given off are so minute that they are cooled before reaching the floor. They would, however, be extremely dangerous in any situation where inflammable vapours or fine dust are met with, and are safest, therefore, in a separate compartment. The brazing of band saws should not be carried on in the same compartment as the woodworking.

Many saw-millers also manufacture builders' joinery, and in such risks we have a number of joiners' benches, and often extra machines of a light pattern, in addition to the hazard of a saw mill proper. Glue is required for use in the joiners' workshop, and I have often found the kettles heated over the gas jets, either suspended by means of a cord and hook, or standing on a couple of pieces of iron driven into the wall. This is objectionable for the reason that an ordinary gas light quickly causes an accumulation of soot, pieces of which may fall while red-hot amongst shavings on the bench beneath; or the glue kettle itself may be lifted down and placed amongst light combustible material. Gas stoves standing on stone or tile are preferable, but they are seldom to be found satisfactorily fixed, indiarubber tubing being commonly used, which quickly cracks, creating an escape of gas, or if the gas be lowered there is the risk of an insufficient force to draw in the requisite supply of air to keep the flame at the burner and it striking back to the hole where the air is admitted and firing the tubing. This danger may be minimised by a piece of

metal pipe and tap near the stove, but it is far safer to get rid of the rubber tubing altogether. Sometimes these stoves stand on the bare woodwork, and at others a thin sheet of metal is the only protection afforded, which, in my opinion, is insufficient. The best means of heating glue is undoubtedly by steam kettles.

Mouldings for picture frames are sometimes made on saw mill premises, the materials used being parchment scraps, resin, and whiting boiled together to form a paste, which is run into a mould, and shaped by having a pattern worked along same until cool.

Lighting.

Gas is the most common form of lighting, and the brackets are often very insecurely arranged. Wherever possible they should be fixed, and I do not look upon wire or other guards with favour, as they are liable to get covered with dust, chippings, &c., which might ignite and fall on to the floors. Swing gas brackets on the timber sides of buildings or on wood partitions, or fixed in positions where they can be placed under or in contact with inflammable material, are often noticed, and the charred woodwork frequently tells its own tale. A workman might quite unconsciously knock against a bracket while carrying a load and so cause a fire.

Electric light by incandescent or enclosed arc lamps, when properly installed, is undoubtedly the best method of lighting.

Paraffin lamps are used in some cases, especially in villages, and we cannot look upon them as a safe means of lighting, especially when the lamps have glass or china reservoirs. I have found them suspended by a cord and metal hook, and also placed very near woodwork. It is, of course, important that a chain or other substantial piece of metal be used for suspending all lamps, as a cord may get burned or rot, and woodwork in dangerous proximity should be protected. The practice of filling and trimming the lamps while in position should be prohibited, and a warranty inserted in a policy that all lamps should be trimmed in a separate building, and the oil stored there.

Lighting up is often done by means of matches or tapers, and if you wish to see a dark basement, you will possibly find a candle produced to illuminate your path. Amongst light refuse we are never safe where matches are used; some may be dropped and ignited by being trodden upon; a piece of lighted brimstone may fall wh they are struck; or a match which has been used may be thrown own before it is dead. It seems to me that gas rings are

an incentive to the use of matches, even where safe means of lighting up are provided, as it is so much easier to strike a match than walk a few yards to fetch the electric lighter. The carrying of matches on saw mill premises should not be allowed.

Electric lighters are undoubtedly the best means of lighting up, and should, where possible, be insisted on. Locked lamps burning vegetable oil, with a tube in the bottom of the lamp, may safely be used.

Portable naked lights of every description should be prohibited.

Heating.

Some woodworking risks are not heated at all. In others low-pressure hot water or steam is used. Stoves may be found in the joinery department, but they, and ordinary fires, are seldom met with on saw mill premises, nor do we see high-pressure hot water apparatus.

Steam and hot water pipes are much better overhead, but are often found near the floors, where they become covered with refuse, of which oily rags might form a part; thus constituting very favourable conditions for spontaneous ignition. Heating pipes should always be clear of woodwork and combustible material of every description.

Where stoves are used, we frequently find that they stand in metal trays, sometimes flush with the floor, and in other cases standing on legs or loose bricks. These are not satisfactory, the metal tray flush with the floor being insufficient protection to the latter, and the spaces between the trays and the floor in the other cases become receptacles for litter. The trays require careful examination, as they are often found full of ashes and other refuse, or they may be rusted or fused through. It is obvious that the safest bases are those of stone, slate, or cemented brickwork, on which metal trays with upturned rims of sufficient height containing the stoves should stand, two feet clear of unprotected woodwork. The smoke pipes in many cases are of sheet iron, which soon becomes unsafe from the effects of the heat. Those of cast iron are to be recommended. They should have tight joints, be 9 inches clear of inflammable material, and where entering the chimney breast any space left between the pipe and the brickwork should be filled with cement. It is not unusual to find pieces of sacking, paper, &c., placed round the pipes at this point.

Driving Power. The most general source of power is a steam boiler and engine, but gas engines are now frequently used, and occasionally an oil engine may be met with. Saw mills with boilers inside are undesirable for obvious reasons, the proper place for the boilers being a separate building altogether. Gas and oil engines, especially the latter, are also best outside the main risk, but are often found in a compartment divided by a wooden partition within the mill.

Chippings and other refuse from the mill are to a great extent used as the fuel for the boiler fires, and consequently a considerable quantity may be found in the stokehole. It is, therefore, very desirable that no communication whatever should exist between the mill and boiler house. We know that fireproof doors are often left open, and if it is the practice to carry refuse through them, there would probably be a continuous feed to spread a fire. A separate brick compartment for waste in front of the stokehole, with an iron trap through which it can be drawn as required for the furnace, is desirable, but only in isolated cases do we find one provided. Boiler flues are also a great source of danger to timbers placed in too close proximity thereto. Two separate fires occurred only a few months ago in a boiler house from this cause, but fortunately they were quickly discovered and got under.

Steam engines are often in a brick compartment communicating with the mill, but possess no special hazard. It is important, however, that the main steam pipe from the boiler be free of woodwork. Gas and oil engines frequently have exhaust boxes and pipes in contact with woodwork, and an idea seems to prevail with some people that there is no danger from this source. Only a few days ago, however, I found woodwork in the open air badly charred through contact with an exhaust pipe beyond the exhaust box. The gas bags to gas engines should always be protected with metal. In the case of oil engines the stock of oil should be stored in a separate building apart from the property at risk, and only brought in as required.

Shafting. Overhead shafting is far preferable to that fixed under the mill floor; being in sight it is more likely to receive attention as regards cleanliness and lubrication. The underground shafting, when in a compartment where dust and chippings fall from the machines,

gets into a very dirty state unless constantly cleaned. However, through the courtesy of the Midland Railway Company, I was enabled to inspect their saw mill a few days ago, where the shafting is all in a basement, but no dust or dirt is to be found there, although refuse is collected in the compartment in a manner which will be referred to later. Under similar conditions shafting may be safer in a basement. In the mill referred to they have an excellent means of cleaning the shafting by cotton waste fastened to a curved piece of metal attached to a long wooden handle. By holding the waste on the shaft as it revolves the latter is kept in splendid order. You will also see that this does away to a very great extent with greasy wipes.

Lubrication. This is of the utmost importance, and self-lubricators, where possible, should be fitted, constant examination being made that they do not run dry, or the flow be choked by the dust. In places where it is not possible to have self-lubrication, every care is necessary to see that the bearings do not get heated, as in all probability there will be a quantity of sawdust or refuse, perhaps oily or wet, near them, especially at the base of under-geared machines. Metal lubricators in which a special kind of grease is used are very desirable additions to the bearings of the spindles, &c., of all fast-running machines, and there are very few places where they cannot be fixed.

A saw-miller of my acquaintance told me that overheated bearings could always be detected by the stench arising therefrom, but he attributes a serious fire on his premises to this cause, and we can only assume that his nose was at fault on this occasion.

Drying. Compartments heated by steam or low-pressure hot water apparatus are generally used for this purpose, and it is important to ascertain that the pipes are kept well clear of the floors and stock, but drying rooms are not too orderly as a rule, wood being often placed on the pipes and a certain amount of litter left to accumulate. Where steam or hot water is the heat used, the position of the boiler firing place and flue requires to be carefully noted.

A perforated iron floor over the boiler and firing place is frequently used for drying purposes. In this case we have the risk of sparks arising from the boiler fires on raking out the

clinkers, and also of the refuse in the stokehole taking fire. In the latter event an outbreak might be coped with if the refuse alone were involved, but with dry timber above, the aspect is entirely changed. If the boiler flue pass through a drying room of this description, it is quite possible timber will be stacked against it.

Drying on the boiler-crowns is the most hazardous, but we are always told that it is not done. It is just as well, however, to ascertain if there be any traces, especially where no recognised drying room exists.

Disposal of Waste. Perhaps the chief feature of woodworking is the quantity of refuse made, and the disposal of it is a matter of no small moment both to the proprietor of the premises and the Offices. Where steam power is employed a large quantity is used for fuel, as already stated; but in mills where gas or oil engines are the motive power the whole must be disposed of by other means. Even in the former case it is seldom that there is not a considerable surplus for disposal. Some have regular customers for it, and others depend on casual callers, who, by the way, have generally neglected to call when you visit the premises. The boys whose duty it is to clear away the refuse are also a constant source of trouble, as one or other is almost sure to be away ill!

Where machines are worked on the floor level and have no opening beneath into a vault, the regular removal of waste becomes a matter which cannot be neglected, or the machine would get choked; but where there is a basement there is the risk of it being allowed to accumulate to a considerable extent.

In constructing a building it would not seem to be very difficult or expensive to lay a small tramway and to allow for a cartway at the entrance of a basement for facilitating the removal of refuse. This would seem to be a simpler method than the present system of bagging it by hand and carrying it out.

The Midland Railway Company have an excellent method of collecting their refuse by means of hoppers made of tongued and grooved boards attached to the ceilings of the basement, and venting into bags affixed to their lower ends. Consequently there is an entire absence of loose refuse, and what is thrown off on the upper floors by the knives of planing and moulding machines is cleared out of the building each night. Their method of dealing

with the dust from frame saws has already been explained in connection with those machines. This reaches the floor of the basement, but is cleared up as made.

A pneumatic system of removing wood refuse by means of fans and suction pipes, and depositing it in the stokehole or direct to the boiler fires, has been devised, and Fig. 19 (A, B, C, D) will illustrate same. It depends for successful working on a proper arrangement of hoods and hoppers to the machines, and the pipes for conveying the waste having long sweeps to all curves, and no sharp angles or projections. The tubes must be airtight, otherwise they are liable to choke. This system is not suitable for dealing with long shavings from planing machines, or those made by joiners, which are liable to ball and get round the blades of the fan, causing them to break. The cyclone in connection therewith being in the open air, any refuse remaining therein overnight may get wet, and unless cleared out before the fans are again brought into use, it will probably clog and choke the apparatus. The idea is an excellent one, and we can only wish it success, care in the directions indicated being the chief requisite.

Where the apparatus is in use, it is, of course, necessary to ascertain what steps are taken to remove shavings unsuitable to be dealt therewith.

All premises should be swept out each night after work has ceased.

Surroundings. It is of importance that the nature of these should be ascertained, and I would point out that such works as foundries, not of themselves specially hazardous, may be a serious menace to a saw mill.

Appliances. Some means for dealing with a fire at its inception are very desirable, for when these are not at hand in a risk of this class, there is very little hope for the premises; but appliances without men trained to use them, even with a plentiful supply of water, are almost worse than useless, as they give a false impression of security. Automatic sprinklers are, of course, the best; next come boiler pumps, hydrants (which I think should be outside the building) and hose, the latter if possible kept attached to the hydrants to prevent loss of time in utilising same; hand pumps, extincteurs,

and buckets are all serviceable as a first resource, but buckets are frequently found empty, out of their proper places, and put to uses for which they are not intended. It is very necessary that fire buckets should have covers, be filled periodically, and, where hand pumps are not provided, mops or other such medium for beating out a fire when occurring at a height might prove a useful addition, as it is impossible to reach far with a bucket alone.

A reliable watchman, checked by means of telltale clocks, and knowing how to handle the appliances, is a decided safeguard, provided he has ready means of summoning assistance.

It is most essential, in my opinion, that a man, or men, should be left on the premises after closing for such time as will allow the bearings to thoroughly cool down, and whose duty should be to go through the premises to ascertain if there be any trace or smell of burning material.

The distance from a fire brigade and the water supply have also to be taken into account.

TIMBER YARDS.

When on saw mill premises, the sheds covering the timber, which are nearly always built of wood, are sometimes found practically adjoining the mill, in fact, close enough to mean communication, and extending over a large area without any division whatever; or the stacks of sawn timber may be piled so as to form a continuous hazard. In all probability there are railway sidings into the sheds; locomotives unprotected with spark arresters enter same, and stokers, as a rule, are not very particular where they rake out the clinkers from their fires. Apart from this the stacks form convenient nooks in which to have a quiet smoke, and we have also the risk of outside attack.

I do not think the minimun rate of 21s. is adequate for timber within 5 yards, or the 12s. 6d. rate is sufficient for timber within the 30 yards limit where the same is stacked in a continuous line from a mill rated at 42s. per cent.

The red-hot cinders which are emitted in considerable quantity from the funnels of railway engines are sometimes as large as your finger-top, and it may be supposed that great risk of fire arises to very dry timber from this cause, especially in the summer time, when the ends of the boards are protected by sacking, or some textile fabric.

JOINERS AND BUILDERS.

The larger of these risks where power is used possess much the same features as saw mills, but fewer machines are required, as a rule, and log-sawing is seldom done. The degree of hazard varies with the number of machines, until we arrive at the small joiner using one circular saw driven by a gas engine.

Workshops where manual power only is employed have no special hazards beyond what have already been dealt with, unless it be the open fires and small oil stoves for heating glue which are sometimes used. The only fireplaces to be recommended are those with an iron shutter which can be lowered to completely shut off the fire. Oil stoves are likely to get upset, and are therefore dangerous. To refuse to insure journeymen joiners' tools in their master's workshop should be one of the greatest safeguards in preventing fires in risks of this description.

CABINETMAKERS.

In these, too, the principal feature of the risk is that of wood-working, varying in degree from the saw mill to the hand-power joiner. We have, however, other processes which must be noticed, viz. :—French-polishing, painting, and upholstering.

French polish is a mixture of methylated spirit and shellac applied to articles of furniture by means of rags. The workmen consider rags which have been used for some time preferable to new ones, and therefore they are carefully preserved. As these are impregnated with spirit it is necessary that they should be kept in closed metal receptacles, and not left exposed about the benches.

The quantity of spirit and polish kept, and the place of storage —which should be in a separate building—are also elements to be considered. Painting materials should likewise be kept outside the main risk. Polishing rooms are generally kept very warm to dry the polish quickly.

Upholstering is a hazardous process in view of the materials used, viz. :—Shavings, wood wool (*i.e.*, finely divided shavings), hay, straw, and other vegetable fibres, seaweed, cotton and wool flocks, and hair, varying according to the class of work done. Great care is necessary with regard to the lighting and heating

arrangements, and all materials not used up at night should be returned to a storeroom, in a building apart from the main risk, where no light or heat is used. Upholsterers' premises are very untidy as a rule.

WOODTURNERS.

These use lathes chiefly, and in large workshops, especially where bobbin-turning is done, the quantity of waste made is enormous. It is not unusual to find the floors knee-deep in refuse, and the arrangements for removing same in the majority of cases leave much to be desired.

BOXMAKERS.

The boxmaker usually has a number of circular saws, and also fixed-knife planing machines, which have an indiarubber-covered roller for passing the timber over the knives. These latter make long shavings, and the saws a great quantity of dust, which is difficult to dispose of. Drying is done to a large extent, and in a risk which I inspected a short time ago it was carried on in a brick-arched compartment over the boiler-crowns. There was an ill-fitting door to this compartment, to which pieces of sheet-iron were nailed. Immediately outside the door was a wooden staircase leading to the mill, and the windows thereof were overlooking same. About four feet from the boiler fires was a wooden barrier holding up refuse, of which there was a large accumulation. Boxes are often branded in these risks by fuel or gas heated presses, but at other times the marking is done by means of inked blocks.

In such risks as cigar box factories we meet with labelling rooms, in which will be found glue kettles usually heated by means of gas rings or steam. Where the former are used they seldom have anything but thin sheet-iron as a protection to the bench, and often the bench is absolutely unprotected.

WHEELWRIGHTS AND COACHBUILDERS.

We do not meet with many risks of this class where power is used, but they possess a few peculiarities which may be mentioned. Firing of tyres is one of these, and it is done either in a properly constructed brick furnace inside or outside the buildings, or on a heap of shavings in the yard. Where the buildings are of timber

construction the latter method is not safe. The tyres are afterwards placed on the wooden portion of the wheel and shrunk by means of water applied thereto.

Lamp black is often kept in wooden tubs in these risks, and it is important that there should be substituted metal receptacles standing on brick or stone.

Painting, varnishing, and upholstering are carried on in most cases.

The machines adapted to wheelwrights' work shown in Figs. 20, 21, and 22 may be interesting.

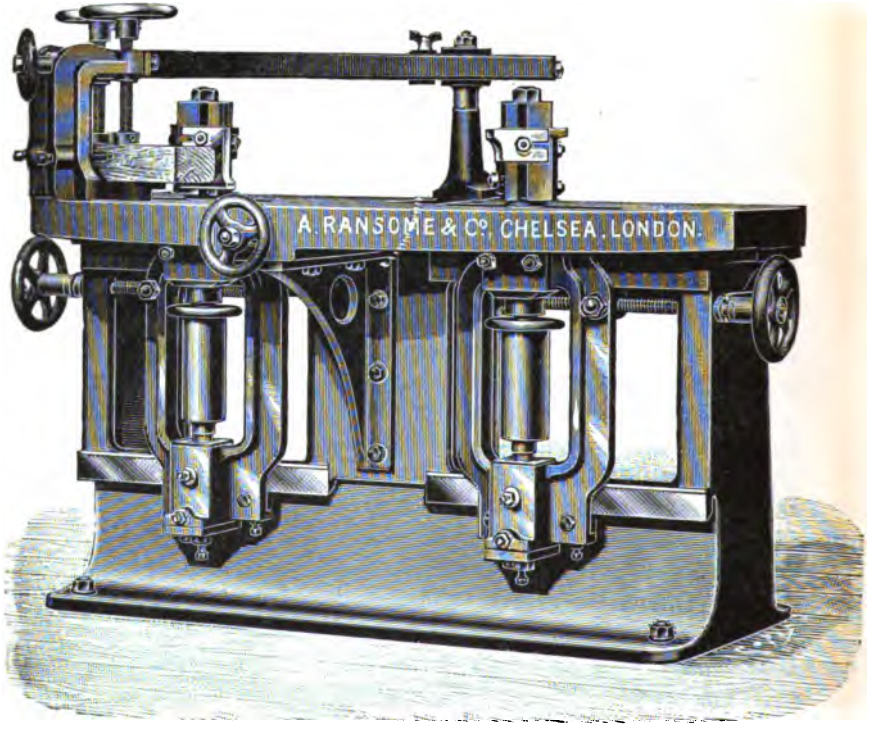


Fig. 20.—Felloe Shaping Machine.

MANAGEMENT.

Management is the most important consideration, and there is no reason why a saw mill should be disorderly. In really well managed risks the lights will be securely arranged, and lighting up done by means of electric lighters or locked lamps. If

paraffin lamps must be used they will be filled and trimmed outside, and some person made responsible for looking after the lighting arrangements. Heating appliances will be found clear of wood floors and all combustible materials. Dust should not be met with on the shafting, bearings, etc. Lubricators will receive proper attention, and where drip tins to catch oil from the bearings can be fitted they should be met with. Lubricating and illuminating oils should be stored in a separate compartment, and not in the dirtiest corner of the mill as is often found. Refuse will be removed regularly, especially from bearings, and no accumulation thereof allowed in the boiler stokehole. Smoking should be prohibited and arrangements made for inspection of the premises after closing. The fire appliances should also be found ready for use.

In connection with smoking it is instructive at times to be about when workmen return from meals. I had occasion to call at a saw mill a short time ago before work had recommenced, and found workmen smoking in a drying room, and one quietly enjoying his pipe at a circular-saw bench.

In conclusion, my thanks are due to several of our members who have given me information: to Messrs. A. Ransome & Co., Ltd., of Stanley Works, Newark-upon-Trent, saw mill engineers, who have enabled me to illustrate the paper and given me facilities for acquiring details regarding the various machines: and to the Midland Railway Company for permission to view their carriage works and inspect the excellent manner in which their shafting is arranged and waste collected.

T. B. REDGATE.

Nottingham Insurance Institute,
March 7, 1902.

FIREPROOF BUILDINGS AND FIRE-RESISTING FLOORS.

In this paper it is proposed to deal with what may be called modern fireproof structures used for manufacturing and warehouse purposes, and we shall not describe the stone or brick arches, domes, or vaults which were erected hundreds of years ago.

The erection of brick or stone buildings which have their floors constructed of brick arches supported on iron beams and columns may be said to date from the first few years of the 19th century, and a cotton mill of this construction was erected in Salford in the year 1801.

The system used in the early fireproof structures was what is known as broad brick arches, and this consists of a series of arches about 10 feet 6 inches from centre to centre of each arch, supported on the bottom flanges of iron beams which rest on iron columns.

Each arch had usually a thickness of 9 inches of brickwork at the spring, which was reduced to 4½ inches at the crown, but some were of specially strong construction, having brickwork 14 inches thick at the spring and 9 inches at the crown.

The arches and beams were securely bound together by means of tie rods and cast-iron arch ribs, which were placed at intervals and surrounded by the brickwork of the arches.

Fireproof buildings on this system have been erected up to the present time, and up to about 30 years ago it was the only system in use.

The floors in the early buildings erected were of tiles laid in the concrete placed on the top of the arches, but, as tiles were very cold to the feet of the mill operatives, boards were usually substituted in the later erections. The boards were nailed to wooden joists or battens placed flush with the top of the concrete.

Where tiles were used, or the wooden flooring boards were nailed flush with the concrete, there was no cavity under, but in some buildings the wooden joists were simply placed

on the crown of each arch, with the result that a space was left under the boards along which a fire would travel.

At the time when fireproof buildings were first erected the rooms were much less in width than what is necessary now, and in consequence of the weight of the floors in the broad brick arch system endeavours were made to construct a lighter floor. Another reason was that it was necessary to reduce the thrust against the beams which always exists when broad brick arches are used.

When, therefore, the wide mills which are now necessary were first erected the system known as narrow brick arches was invented. The first example of this system was erected some 30 years ago.

The arrangement consists of small arches which are erected at right angles to the main beams and supported on transverse iron joists which rest on bearers placed part way down the main beams.

The arches are about 3 feet from centre to centre instead of 10 feet 6 inches in the broad system.

This narrow-arch system has reduced to a minimum the thrust on the main beams, but it leaves a large proportion of ironwork exposed to the action of a fire. Another feature is that it is not so heavy as broad brick arches.

The tops of the arches were in some cases levelled up with concrete, but in others the joists were merely placed over the arches without any filling up, thus leaving the dangerous concealed space under the boards before mentioned.

In addition to the broad brick arches and the narrow brick arches there have been erected for a number of years arrangements of brick arching which are almost too numerous to mention.

There is not space here to describe them in detail, but it may be mentioned that in cotton mills the principal cause of the changes from the original design has been the necessity of having wider bays, so that the iron columns may not be placed at inconvenient positions amongst the machinery.

Up to the present we have only described bays 10 feet 6 inches wide, but for the reason last mentioned bays 21 feet wide have been constructed.

The main beams have been erected 21 feet apart, and from beam to beam transverse joists are placed on which the brick arches are erected.

This is a system similar to the narrow brick arches, but from centre to centre the arches are wider.

Another arrangement of brick arching has been to construct a

system of panels by erecting heavy beams both longitudinally and transversely. When this is done it is impossible to declare in which direction the arches run, and I therefore describe the ceiling as in panels.

The use of ordinary solid bricks has also been departed from to some extent, and hollow bricks and moulded tiles have been used. It is, of course, nearly always a matter of expense, and if an architect had permission to erect a building regardless of cost he could often make it fire-resisting to a much greater extent than is usually the case.

The next method of construction, and it is one much in use, is concrete instead of brickwork.

Usually the concrete ceilings are quite flat almost if not quite up to the main beams, but concrete arches have been erected in a few buildings, which is quite an exceptional arrangement.

The construction of concrete floors consists in placing the joists, usually steel, from beam to beam, and these joists support the concrete which is placed between them. The joists vary from 4 to 6 inches in depth, have about 2-inch flanges, and are placed from 18 inches to 2 feet apart.

At first the joists were placed on the top of the main beams, but as this arrangement caused nearly the whole of the main beams to be exposed to the action of a fire the joists have, in some buildings erected in recent years, been placed in the bottom flanges of the main beams. When this is done only the under side of the main beams is visible, which is about the same as in the broad system of brick arching.

Another arrangement has been to place the joists on angle-iron bearers fastened part way down each main beam, the concrete being continued to the under side of the bottom flange of the latter, thus encasing all the ironwork with the exception of the metal columns.

Concrete floor construction has many advantages, as it gives a substantial and strong floor, and there is no dangerous thrust on the beams and walls to guard against. It is also lighter than brick arching.

In addition to the concrete floors we have described, the material has been used in several special forms of construction. For instance, there is Stuart's Granolithic system and Hennebique's system, both of which are so arranged that the ironwork is entirely encased in the concrete. In the Hennebique system the

ironwork is simply an arrangement of wrought-iron rods suitably fixed.

Mention must now be made of the mills and warehouses constructed in the United States of America, particularly the New England States, on what is termed "slow burning construction."

In the United States, timber being much cheaper than iron, it had therefore paid the mill owners better to use timber for columns, beams, and floors without almost any ironwork in the construction.

The "slow burning construction" consists of a floor of 3-inch planks laid on wooden beams, say 14 inches by 12 inches, which are supported on pine columns 8 inches by 10 inches. On the top of the planks is spread a layer of cement or mortar ¾-inch thick, or two thicknesses of asbestos paper, and over all a hard flooring board 1½ inches thick. The roof is nearly flat, and consists of planks nearly as thick as those used for floors, over which is laid roofing felt, preferably treated with tar and gravel.

This style of construction may in many respects be better than our fireproof mills with the exposed ironwork, but it is very doubtful whether it can be considered better than our floors with the iron beams and columns efficiently protected.

The good features are that there are no concealed spaces in either floors or roof, and water does not easily pass from one floor to the other.

Another type of construction brought over from the United States is that instead of 3-inch planks the floors consists of wooden joists placed close together on edge and securely nailed. The joists are 5 or 7 inches deep, nailed together, and over them is laid asbestos paper and then a hard boarding, say, 1 or 1½ inch thick.

The beams are of wood, say 16 inches by 10 inches, and they rest on wooden columns from 10 inches square to 12 inches by 14 inches.

It will be easily seen that, providing such a floor is kept intact and has no openings for staircases, driving ropes or belts, and the like, it will resist a very intense fire without giving way. There is no iron or steel to fracture or warp, and the charring of the outside of the woodwork will not affect the stability of the structure.

We will now deal with the ironwork used in the several fireproof systems erected in this country.

For the broad brick arches cast iron has been almost invariably used for the beams, and this remark also applies to the main beams of the narrow brick arched system.

In the mills erected during the past 20 years, wrought-iron and steel beams and joists have been extensively used.

Many authorities are of opinion that the use of cast iron for the main beams has been the cause of several disasters which have occurred in mills during the last 12 years. The defect of cast iron is that when subjected to intense heat it cracks and flies into fragments, especially when water comes into contact with it. Wrought iron and steel resist the action of a severe fire for a longer period than cast iron, but when under these conditions for a sufficient length of time they have a tendency to warp if they cannot expand freely. Space should, therefore, be allowed for such expansion, but it is difficult to allow sufficient in view of the width of the mills which are being erected at the present time.

Although the metal used for girders, beams, and joists can be varied, it is almost never considered advisable to deviate from the practice of using cast iron for the columns. Cast iron resists a compressive strain better than wrought iron, but the latter is more suitable to resist a tensile strain.

Dealing with floors according to their capabilities for resisting fires, it is certain that the smaller the surface of ironwork exposed to the action of a fire the better. In the broad brick arching and the concrete system, where the joists are placed on the bottom flanges of the main beams, there is a small surface of metal exposed to the action of a fire, but in the narrow brick arched system and the early concrete type, where the metal joists supporting the concrete were placed on the top of the beams, there is much more ironwork visible than is desirable.

Speaking of three of the disastrous fires which have occurred in fireproof cotton mills during the last twelve years, it will be noticed that they either broke out in, or extended to, mule spinning rooms, where, in consequence of the extreme length of the mules and the solidity of the woodwork of the carriages, there is much combustible woodwork, all saturated with lubricating oil.

When a fire occurs in these rooms, and the operatives are driven out by the heat and smoke, the fire burns without interruption except for the efforts of the fire brigade, and it really becomes a question whether the ironwork can withstand the intense heat without expanding and thrusting out the walls or becoming

fractured, either of which will be almost certain to result in the destruction of the building. There is also the danger of the cast-iron columns giving way under the intense heat.

Added to the danger to the ironwork from the heat of the fire, there is the possibility of the water from the hose streams being thrown against the metal when it is red-hot, with the result, so far as cast iron is concerned, that the sudden cooling causes it to fracture.

Mention has been made of three of the best-known disastrous fires in fireproof cotton mills during the last twelve years. The two first, Messrs. W. Holland & Sons, of Miles Platting, Manchester, which took place in August, 1890, and the New Hall Spinning Co., of Burnley, on October 20th, 1897, were buildings constructed with the narrow system of brick arching, where a large proportion of the main cast-iron beams is exposed to a fire. After the New Hall fire it was remarked that very probably, if the system of fireproofing in both cases had been the old-fashioned broad brick arching, with only the bottom flange of the cast-iron beams exposed, the result would have been different, but this theory held good no longer when the Werneth Spinning Company's mill at Oldham was destroyed by fire in October, 1899. This latter mill had the old-fashioned broad brick arching, but the destruction was quite as complete as at the two mills first mentioned.

The width of the rooms at each of the thee mills was not less than 120 feet.

Another feature was that, whereas in Messrs. Holland's fire the scene of the first outbreak was the engine-house, where millwrights were working during the night, and very probably the fire spread along the main upright and horizontal shafts into more than one spinning room, the fires at the New Hall Spinning Co. and the Werneth Spinning Co. commenced during working hours, and although there were workpeople present who could use the fire-extinguishing appliances, the fire gained headway and the buildings eventually collapsed.

Before closing these remarks on fireproof mills recently destroyed, we must not forget to mention the one at Bridge Mills, Hadfield, on June 5th, 1899.

This fire commenced in the rope race and spread upwards to the roof, which was not cut off from the roof of the main building. The fire therefore spread to the main mill roof, which was non-fire-

proof, and had heavy timbers covered with heavy stone slabs. The roof fell in, and its weight broke through the fireproofing below, carrying the fire to the lower storeys.

Up to the present time there does not appear to have been a mill destroyed by fire where the flat concrete system has been adopted, but it is doubtful whether the flat concrete ceilings with the whole of the main beams exposed will withstand a severe fire.

The experience of the Offices would therefore appear to prove that if there is sufficient combustible material in a fireproof building to generate an intense heat, there is great danger of a collapse of the ironwork, especially in very wide buildings.

It is of course possible that if the brickwork used has been of inferior quality, or the arches badly constructed, such bad material and workmanship may account for a disaster.

The possibility of the collapse of a fireproof building has been increased during the past 30 or 40 years by the much greater width of the buildings.

If you will refer to your plans of the early fireproof mills you will find that they seldom exceed 50 or 60 feet wide, often not more than 50.

With such comparatively narrow buildings, and the arches running from side to side, there is not sufficient length of iron beam to cause them to expand sufficiently at the time of a fire to force out the walls. Moreover, with a building so narrow it is comparatively easy to keep the metal cool the whole width of the mill by means of water from fire hose used in the yard.

With a broad building, however, having a width of from 120 to 140 feet, there is such a long length of ironwork to be affected by fire that the expansion of the iron beams is liable to force out the walls, seeing that such expansion must be great in the long length, or perhaps, being unable to expand freely, the ironwork may warp. Compared with the narrow buildings it is difficult, and in fact almost impossible, to command the whole of the ceiling with the jets from hose.

It will have been noticed that great stress has been laid on buildings in which mule spinning is carried on, particularly in large and wide buildings.

There is no doubt that in fireproof buildings occupied for frame spinning, as in ring spinning (cotton) mills, and in worsted, flax, and jute mills, there is scarcely sufficient combustible material to cause the fireproofing to give way. As to woollen mills, fires

seldom occur in the mules, and then the carriages are shorter than in cotton mills and the speed of the spindles much less.

Attempts have been made from time to time to erect fireproof corn mills, and there are now existing a few mills with fireproof floors, but the effort is almost a complete failure, because the floors must be pierced for numerous elevators, spouts, and driving straps, and these form communications between the various floors. Moreover, as millers are often changing their machinery, new openings have constantly to be made in the floors, and the necessity of having to pierce through the fireproofing for new elevators, &c., causes it to be considered an unnecessary difficulty which can be overcome by substituting wooden floors.

In order to reduce the possibility of water passing through the floors, it has been made in some cases part of the contract when erecting a fireproof mill that so many inches of water shall stand on the floors for a certain length of time without passing through.

This is all very well when the concrete or brick arches are newly laid, but the true test should be when the floors are thoroughly dried—in, say, one year's time. If the test were made at this latter period very few floors would be found satisfactory from the leakage standpoint.

In this paper reference must be made to the fireproof doors which have to be erected to communications requiring such protection.

It is only during the last ten years that a complete specification has been issued by the Fire Offices' Committee stating clearly how the doors should be constructed and erected, and the details were very necessary, because in many instances the so-called fireproof doors were badly made and so defective that although they were sufficient to prevent a higher rate being carried from one building to another, they would certainly not have prevented a fire travelling through them.

When an opening is protected by double iron or double metal-covered doors constructed and erected strictly in accordance with the specification there is no doubt the protection is as efficient as it is possible to be. Of course a perfect brick wall is better, but then doorways are a necessity.

As to iron doors, the stipulation that the styles and rails shall be on each face of the plate causes the door to be strengthened very much, and tends to prevent warping. The provision of the

wrought-iron rebated frame and the bolts at the top and bottom are also great improvements.

There is great difficulty, however, in finding a firm of machinists who will make the doors to the specification, because they often place the styles and rails on the room side, or face, of the door, instead of on each face, and the iron frame is sometimes made of cast iron instead of wrought. The bottom bolts are also sometimes arranged to fit into the wooden floor instead of into the metal frame.

All these details are of the utmost importance, and call for careful attention on the part of Surveyors when inspecting the doors.

Metal-covered doors have only been introduced into this country from the United States of America during the last twenty years, and the first examples which were constructed here could not be termed satisfactory. This was through want of proper particulars, and in fact it was found necessary to bring over from the States a sample door in order to see exactly how they were constructed.

It is of vital importance that when constructing a metal-covered door the specification shall be followed in every detail, and it is even more difficult with this class of door to find a firm who know how to make one than it is for an iron door.

The intention is to so attach the tinned sheets to the door that they shall remain in position at the time of a fire and be as air-tight as possible. When the air is excluded a layer of charcoal is formed on the surface of the woodwork inside, but the door is not affected otherwise.

To this end it is very essential that the sizes of tinned sheets mentioned in the specification should not be exceeded, the lock-jointing should be good, and the sheets thoroughly secured to the woodwork by the barbed nails or screws. No solder must be used anywhere. All these precautions are so that the tinned sheets will remain in position close to the workwork at the time of a fire.

One or two cases of failure in the action of metal-covered doors have undoubtedly occurred, but they have been where the doors have not been properly constructed, and in one instance the fault did not entirely rest with the firm who constructed the doors.

In the construction of fireproof mills there has been a tendency of recent years to enlarge the external windows, and thereby reduce the brickwork between the several storeys.

This defect should be avoided in every way, because it is possible for a fire to spread externally from one storey to the other.

In connection with the question of window space, attention must be drawn to wired glass, which, like metal-covered doors, has been introduced into this country from the United States of America.

Wired glass is plate glass which has wire placed in the centre. The glass is intended to be used for external hazards to windows, and the effect when exposed to fire under such circumstances is that the glass cracks but does not fall away. There are therefore no holes in the window through which a fire can pass.

It must be remembered that the wired glass must be fixed in the special metal frames intended for its use, as of course ordinary wooden window-frames are not suitable. Under proper conditions the use of wired glass will be the means of preventing conflagrations, and there is undoubtedly a future before it.

We will now consider what precautions should be adopted when erecting a fireproof building and what undesirable features should be avoided. Since I was requested to read this paper the rules for Standard Fire-Resisting Buildings have been issued by the Fire Offices' Committee, and the suggestions now made are based on the requirements of the rules in question, although, at the same time, deviations are dealt with, as the rules only apply when it is proposed to erect these special buildings, and in many cases firms will be unable to comply with the special requirements.

In the first place, the use of stone should be avoided in the walls as much as possible, because experience has shown that when exposed to a fire stone cracks and splits to pieces and the walls crumble away. The walls should, therefore, be of bricks, terra-cotta, or concrete.

The area covered by a building, together with its height, should not be excessive, because, as already mentioned, if the contents of large buildings are combustible there is great danger, if a serious fire should occur, of the stability of the structure being endangered.

The roof should be composed of incombustible material, and the placing of non-fireproof roofs having heavy timbers in the construction should be carefully avoided.

When concrete is used for the floors there should be no stone used in its composition, but only broken bricks or some other hard and burnt material.

Another safeguard is to place the floor boards flush with the top of the concrete, when either bricks, concrete, terra-cotta, or fire-clay be used for the floors, and when the system is brick

arches they will have to be levelled up on the top with concrete, into which will be sunk the joists or fillets of wood to which the flooring boards are nailed.

The solid wooden floors, some six or eight inches in thickness, make an excellent fire-resisting floor, and of itself will withstand a severe fire for a considerable time. One other favourable feature connected with them is that there can be no concealed spaces.

In many fires attention is drawn to the great water damage which takes place through water being unable to drain away from the fireproof floor into which it is thrown from the hose except by percolating through the brick-arched or concrete floor into the rooms below. The remedy recommended is an arrangement of scuppers, which are metal spouts passing through the outer walls at the floor level and fitted with metal lids which open outwards only. When the water accumulates on the floors it drains away through these scuppers and escapes down the outside of the building before it has time to percolate through the floors, thus preventing much water damage. Care will have to be taken that the metal lids are well fitted, so that cold air cannot enter the rooms, and the lids will require to be examined periodically to ascertain that they are not shut fast.

There are some mills erected which are partially fireproof. That is, perhaps the ground floor has a fireproof ceiling, but there are several non-fireproof floors over, or say three lower floors are fireproof and the top storey or attic may be non-fireproof.

Such structures cannot be considered fireproof mills in any satisfactory sense, because if the upper non-fireproof parts fall in at the time of a fire the fireproof room or rooms are in all probability destroyed.

Recently there have been a few mills erected with non-fireproof roofs (the rest of the building being fireproof), but this is exceptional. As to the mills with several floors non-fireproof, they were mostly built some 70 or 80 years ago, and such an arrangement would not be thought of at the present time.

Another feature of vital importance which should receive careful attention is the protection of structural metal work.

As already mentioned, it is preferable that the girders and beams should be protected as much as possible from the heat o a fire by the bricks or concrete forming the floors, and thus leave only the columns to be protected. This should be done by

arranging for the brickwork or concrete to rest on the bottom flanges of the main beams or girders. As for the columns, their protection requires good workmanship, because unless the bricks, terra-cotta, cement, concrete, or plaster are securely erected there is danger of a collapse, thus leaving the pillar unprotected, perhaps at a critical time, and, moreover, in warehouses where goods are conveyed to and fro on trucks, or goods in cases are being handled, there is a probability of the protection to the columns being knocked off. The provision of a metal guard round the lower part of each column as a further protection to the brickwork, &c., is essential.

Openings through the floors for staircases, well-holes, rope and strap races, and the upright driving shaft, if any, are, next to the material used in the construction, the most important matters to be considered by the Fire Offices.

Speaking first of warehouse and shop risks, we often find that the building is well constructed, but the fireproofing is altogether spoiled by openings for areas, well-holes, hoists, and staircases. If these defects are pointed out to the assured, the reply is that the areas and well-holes are necessary, so that the different rooms can have sufficient light, and as to the staircases, the brick-enclosed staircases usual in mills cannot be tolerated, as it would be an eyesore and out of place. All this is quite right so far as appearance goes, but if the assured find it necessary to destroy the utility of the fireproofing, the Offices have to consider the premises only little better than one of the ordinary non-fireproof construction.

In mill risks (either spinning or manufacturing), on the other hand, there is no reason why the openings in question should not be arranged so that they will not destroy the utility of the fireproofing.

For instance, staircases through the floors of the building should be carefully avoided, and an external fireproof staircase enclosed in brick walls should be erected outside the four walls of the structure, and preferably communicating with each floor by a fireproof door.

The hoist, if any, should be erected in the centre of the external fireproof staircase, and the objectionable feature of a hoist built against the main building, and directly communicating with each floor, is to be condemned. Many firms who, unfortunately, have had experience of fires will bear evidence to the way in which a

fire will spread up a hoist. Even if the hoists which connect directly with the floors have iron doors to each opening, there is the probability of one or more of the doors being open when a fire takes place. If the hoist has to be erected against or inside the main building it should have its walls carried up all round and have a light wood and glass roof. Thus, if a fire travels into the hoist, it will have a vent upwards. The hoist should also be entered by iron or metal-covered doors.

Openings for rope and strap races, and for the upright driving shafts, next claim attention. The mills now being erected are almost invariably driven by ropes from the main engine, and this is a vast improvement, providing the rope race is well cut off from the remainder of the building by carrying the walls surrounding it through the roof, and having only a communication with the engine-house itself. In buildings where the roof of the main structure is non-fireproof, the importance of thus carrying the rope-race walls through the surrounding roofs is very great, and one disastrous fire in a cotton mill in the North of England would have been confined to the rope race, where it originated, if the walls had been thus arranged. Through the neglect of this precaution, however, in this particular instance the fire spread from the rope race to the main roof, which eventually collapsed, carrying the lower floors with it.

It is thought somtimes that a fire cannot easily occur in a rope race, but, in addition to the case just mentioned, the bearings have on several occasions become heated, with the result that the oil has become ignited and set fire to the ropes, which are greasy. Such fires are difficult to extinguish, as they occur when the ropes are in motion, thus causing the flames to travel quickly.

Strap races should be treated in exactly the same way as rope races, and gearing towers are also very dangerous unless efficiently cut off.

In many fireproof mills the gearing tower communicates with the several rooms by wooden doors, and the floors of the tower are of wood. In consequence of the bevel wheels having to be taken out occasionally it is difficult to have the floors made of ordinary fireproof material, but there is no reason why loose iron plates on iron beams should not be used. The walls of gearing towers should be carried through the roof of the mill, and the gearing tower itself should have a light wood and glass roof. One noted mill was saved through having such a roof to the gear-

ing tower, for when a fire occurred in the tower the glass roof was broken by the heat, thus creating a flue for the fire to vent upwards instead of travelling to each floor of the mill with which the tower communicated. The best arrangement is for the gearing tower to be only entered externally, but if it does communicate with the mill the doorways should be fitted with fireproof doors.

The openings round horizontal shafts from rope and strap races and gearing towers should be protected with well-fitting and substantial metal plates. Unfortunately, very often a thin protection of sheet iron is provided, which is of little use to prevent a fire travelling into the mill.

Driving machinery or shafting by means of straps or ropes through the floors is very objectionable, and it entirely destroys the utility of a fireproof building.

The fire-extinguishing appliances (whether automatic or otherwise) in all fireproof buildings should be ample, well arranged, and kept in good working order.

It should always be remembered that it has so far been found impossible to erect a building which will withstand every fire to which it could be subjected, and, therefore, it is desirable to have means of dealing with a fire and minimising its disastrous results.

W. BEESTON.

Manchester Insurance Institute,
February 11, 1902.

NOTES

ON THE USUAL PROVISION FOR UNEXPIRED RISK IN THE CASE OF HOME FIRE BUSINESS;

AND

ON THE MISLEADING EFFECT, IN FIRE INSURANCE STATISTICS IN THE UNITED STATES, OF LONG-TERM INSURANCE, AND OF THE RAPIDLY INCREASING VOLUME OF BUSINESS.

In Fire Insurance, as in other kinds of business, there are some matters of considerable importance which are apt to be regarded as too simple and too trivial to be worthy of attention.

I remember the time when it was not customary to introduce into Fire Insurance accounts in this country a reserve for unexpired risk. But it would appear now to be universally admitted that there ought to be such a reserve, and that on home business the proper proportion of the annual premium to be set aside as representing the unexpired risk is one-third, or 33⅓ per cent. Nevertheless, I feel some doubt as to whether this elementary matter has even yet received all the attention which its importance demands; and I therefore propose to offer a few remarks upon it this evening.

There is also another point which I think has scarcely had the attention which it deserves: I refer to the disturbing and misleading effect, in Fire Insurance accounts and statistics, of the practice, so common in America, and now apparently on the increase, of granting policies for three or five years at a commuted premium paid down at the outset; and of the almost equally disturbing effect of the rapid increase of the volume of Fire Insurance business generally in America. On this subject also I propose to trouble you with a few observations.

The two matters are very closely connected and they may, with advantage, be considered together.

If fire insurances all commenced as the bells usher in the new year on 1st January, and ceased at midnight on the 31st December following, there would obviously be no unexpired risk at the close of the year, and the true claim ratio, and true profit or loss on the year's trading, could be deduced directly from the figures in the revenue account without requiring any adjustment. But, as everyone knows, fire insurances do not all run from the 1st of January; indeed few, if any, ever run from that date in this country; and hence there is always a liability for unexpired risk at the date of the annual balance.

In the case of home business all annual insurances are renewable on a term day, which may be one of the English term days, Lady Day, Midsummer, Michaelmas and Christmas, or one of the Scottish term days, Candlemas, Whitsunday, Lammas and Martinmas.

The ordinary estimate which places the liability for unexpired risk on home business at one-third of the annual premium income from such business, is presumably based on the assumptions (1) that there is, on the average, half a year's risk unexpired, and therefore that half of the premium income after deduction of expenses and commission ought to be reserved for such unexpired risk; and (2) that the average expense ratio, including commission, is $33\frac{1}{3}$ per cent. On these assumptions, half, not of the whole premium, but of $66\frac{2}{3}$ per cent. thereof, would fall to be reserved. This amounts to $33\frac{1}{3}$ per cent., or one-third of the whole premium income; and it would be the correct reserve (assuming the above estimate as to expense ratio to be right) if the business consisted wholly of annual policies renewable in equal proportions on 15th February, 15th May, 15th August, and 15th November, as on such a business there would on the average be exactly six months' risk unexpired at 31st December, namely—

On Insurances renewable at	No. of Months unexpired.
15th February - - - -	$1\frac{1}{2}$
15th May - - - -	$4\frac{1}{2}$
15th August - - - -	$7\frac{1}{2}$
15th November - - - -	$10\frac{1}{2}$

Adding up the number of months unexpired we get a total of 24 months, and, dividing by 4, we find the average term unexpired at 31st December to be exactly six months.

In the case of insurances renewable at the English terms we find the unexpired risk to be as follows—

On Policies renewable at	No. of Days unexpired at 31st Dec.	Corresponding decimal fraction of a Year.
Lady Day (25th March) -	83 -	·2274
Midsummer (24th June) -	174 -	·4767
Michaelmas (29th September)	271 -	·7425
Christmas (25th December) -	358 -	·9808
	886	2·4274
Average unexpired risk -	221½ -	·6068

Hence, on the assumption of an equal distribution of the business over the four English quarterly terms, the rate of reserve on annual policies would be 60·68 per cent. if calculated on the premiums less expenses—or two-thirds thereof, namely, 40·45 per cent. if calculated on the full annual premiums paid. This latter ratio is considerably higher than the 33⅓ per cent. ordinarily reserved on home business.

An equal distribution of the business over the four Scottish quarterly terms yields, however, a ratio lower than the usual reserve on home business, thus—

On Policies renewable at	No. of Days unexpired at 31st Dec.	Corresponding decimal fraction of a Year.
Candlemas (2nd February) -	32 -	·0877
Whitsunday (15th May) - -	134 -	·3671
Lammas (1st August) - -	212 -	·5808
Martinmas (11th November) -	314 -	·8603
	692	1·8959
Average unexpired risk - -	173 -	·4740

This indicates that, on annual business due at the Scottish terms, *if it is equally distributed*, the proper reserve is 47·4 per cent. if calculated on the premiums after deducting expenses, or 31·6 per cent. if calculated on the full premiums paid.

But I do not think anyone will be bold enough to maintain that the assumption of an equal distribution over the quarterly term days is warranted by the facts either in England or in Scotland. The Fire Insurance clerk who has had to write out

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policies or fire receipts knows very well that all terms are not equally heavy. In England, Christmas is a much heavier term than any of the other three; and in Scotland, Whitsunday and Martinmas are both much heavier than Candlemas and Lammas. While this general notion is sufficient to indicate that the distribution is unequal, it does not give us much help as to the precise proportions falling due at the different terms. I should have liked to have made more enquiry on the subject than I was able to do in the few days available for putting this paper in shape. Through the courtesy of the manager of an important English Insurance Company I obtained the proportions of his Company's home fire premium income falling due at each of the English terms in each of the four years 1897, 1898, 1899, 1900. The percentages differed very little at each term in the different years, and the average for the four years was as follows:—

Proportions due at the four English terms (treating the whole income due at English terms as 100).

Lady Day - - - - -	23 per cent.
Midsummer - - - -	22 ,,
Michaelmas - - - -	23 ,,
Christmas - - - - -	32 ,,
	100 ,,

This I have found to correspond very closely with the distribution of the English business of a Scottish Company, and I have therefore assumed it, although, perhaps, on insufficient grounds, to be fairly representative.

With regard to the distribution of the business due at the Scottish terms, the following information is from only one Company, but it is based on an average of some years, showing little variation from year to year:—

Proportions due at the four Scottish terms (treating the whole income due at Scottish terms as 100).

Candlemas - - - -	14·0 per cent.
Whitsunday - - - -	41·3 ,,
Lammas - - - - -	13·3 ,,
Martinmas - - - -	31·4 ,,
	100·0

Working on these proportions, the following results have been obtained:—

ESTIMATED TRUE RESERVE AT 31ST DECEMBER.

	Calculated on ⅔rds of the actual Premiums.	Calculated on the full actual Premiums.
	%	%
On business due at the English term days - - - -	64·19	42·79
On business due at the Scottish term days - - - -	51·12	34·08

It must be kept in view that these results relate to annual policies alone, and that the percentages of 42·79 and 34·08 respectively, fall to be calculated on those portions alone of the premium income which are derived from such policies.

But, besides annual policies, each Company may, perhaps, have a few long-term policies for 5 or 7 years, and certainly has a good many short-term policies for 1, 2, 3, or 6 months. I propose to omit altogether the element of long-term policies on home risks, because there are very few British Companies which have more than an infinitesimal proportion of such. Many Companies, however, derive a considerable income from short-period insurances, and it is therefore necessary to take that class of business into account in our calculations.

Let us suppose that a Company during each month of the year grants temporary insurances, for an average period of two months, and that the total annual income derived from such is £12,000, or £1,000 per month. Let us also suppose that the insurances run on the average from the middle of the month of issue. Then we shall have practically twelve groups of such insurances, the first starting 15th January, the second from 15th February, and so on. The first ten groups will all run out within the year, leaving the unexpired risk at 31st December. The eleventh group, which starts from 15th November, will leave half a month's risk unexpired at 31st December, and the twelfth group, which starts from 15th December, will leave 1½ months' risk unexpired. If £1,000 be the full premium paid for 2 months' risk in respect of each group, then £666 13s. 4d. will be the premium, less the

allowance for expenses. Hence the total unexpired risk on the short-period insurances works out thus:—

Half a month's risk on one group, equal to $\frac{1}{4}$ of £666 13s. 4d.	£166	13	4
$1\frac{1}{2}$ months' risk on the other group, equal to $\frac{3}{4}$ of £666 13s. 4d.	500	0	0
Total unexpired risk on £12,000 - -	£666	13	4

This result is equal to 5·555 per cent. on £12,000.

Let us now construct two hypothetical Companies, one English and the other Scottish, and let us assume that each does home business alone. In the case of the English Office I shall treat 72 per cent. of the total premium income as due at English terms, 16 per cent. as due at Scottish terms, and 12 per cent. as consisting of short-period insurances, equally distributed over the year, starting from the 15th of each month, and running for a period of two months. In the case of the Scottish Office, I shall treat 50 per cent. of the premium income as due at English terms, 44 per cent. as due at Scottish terms, and 6 per cent. as consisting of short-period insurances of the same character as those granted by the English Company. In assigning to the English Company twice the proportion of short-period business assigned to the Scottish Company, I have had in view the fact that Liverpool and London, in which cities the English Company would presumably have the more influential connections, are the chief fields for short-period insurances; and in assigning to the Scottish Company a somewhat larger proportion of business due at the English terms than that due at the Scottish terms, I have had in view the fact that a substantial proportion of Scottish business is now renewable at English terms. For convenience of comparison I estimate the total premium income in each case to be £100,000.

English Company.

Due at—	Premium Income.	Estimated true Reserve.	%
English terms	£72,000	£30,809	42·79
Scottish terms	16,000	5,453	34·08
Short - period insurances -	12,000	667	5·56
	£100,000	£36,929	36·93

SCOTTISH COMPANY.

Due at—	Premium Income.	Estimated true Reserve.	%
English terms	£50,000	£21,395	42·79
Scottish terms	44,000	14,995	34·08
Short - period insurances -	6,000	333	5·56
	£100,000	£36,723	36·72

It will be seen that the greater proportion of short-period insurances, with their low rate of reserve, allocated to the English Company, nearly counterbalances its greater proportion of unexpired risk on annual policies, and thus brings down the estimated true reserve for the English Company to nearly the same as that for the Scottish Company.

If the two examples can be taken as fairly typical, it follows that the usual estimate of 33⅓ per cent. as the reserve on home business is not so very far out, the true proportion being somewhere about 37 per cent.

It might, however, be contended with some show of reason that the allowance for expenses ought to have been taken at a slightly higher rate than 33⅓ per cent., say at 35 per cent. If this be given effect to, the estimated true reserve in the case of the English Company would become reduced to 36·0 per cent., and in the case of the Scottish Company to 35·8 per cent.

There are, possibly, some Insurance men who may, offhand, be disposed to contend that, besides the expenses, there should be struck off, from the premium, the addition made for profit, before we proceed to calculate the portion of the premium to be set aside as reserve. A very little consideration, however, will, I think, satisfy anyone who looks into the matter that if the proportion of the "risk" premium alone be carried forward to next year, and if the whole loading to provide a profit be brought into the year in which the premium fell due, this will be encroaching on future unearned profits.

I have heard experts say that this question of unexpired risk is of no moment in a steady-going wealthy concern, as, if the premium income does not vary from year to year, the amount of unexpired risk at the end of the year is exactly the same as the amount at

the beginning of the year, and thus the claim ratio and the profit or loss on the business are unaffected by the unexpired risk. This is, so far, true; but if the business came to be wound up, provision would have to be made for the unexpired risk out of the general reserve fund; and where there is an actual and substantial liability, capable of being estimated, the proper course is undoubtedly to make a specific reserve for it. And in the large number of cases in which the business of a Company has largely increased or diminished in amount, as compared with the business of the previous year, no proper idea of the profit or loss made by the Company can be formed unless there be a provision for unexpired risk in the revenue account.

Theoretically, the interest earned on the reserve for unexpired risk ought to appear in the revenue account, although this is not always carried out. Such reserve has been set aside out of the premiums, and the interest which it yields ought to be credited to the underwriting.

I now turn to the second point on which I propose to offer a few remarks, namely, the effect of long-term insurances, and of the annual increase in the business, on the accounts and statistics relating to United States business.

In America, Fire Insurance business has increased enormously in volume within the last twenty years. This is only what might have been expected from the extraordinary development of the country, the building of new cities, the great extension of other cities, and the vast increase in the population, and in the trade, manufactures and wealth of the country. Coincident with the increase in the volume of Fire Insurance premiums, there has been some alteration in their character, a larger proportion than formerly being single payments on insurances for three or five years. The classes of risk insured on this plan in the United States are dwellings, schools, churches, public buildings, office blocks—in fact, all the gilt-edged classes of risk.

As illustrating what I have stated above, I may say that in the year 1880, the Fire Insurance premiums received by all the American Companies reporting to the Insurance Department of

the State of New York amounted to 38,682,324 dols., and their unearned premiums at the end of that year amounted to 25,081,875 dols., or 64·8 per cent. on the premiums received in the year. In 1900 the Fire premiums received by the American Companies reporting to the New York State Insurance Department amounted to 93,827,009 dols., and the unearned premiums of these companies amounted to 78,678,423, or 83·9 per cent. on the premiums received in the year.

The unearned premiums are arrived at thus: On a yearly policy the Insurance Company is bound under the laws of the State of New York to reserve a full half-year's premium, and on a five years policy, to reserve, in respect of the current year's risk one-tenth of the whole single premium paid for the five years, and in respect of each future unentered year of risk to reserve two-tenths (one-fifth) of the whole single premium for the five years. Hence on a five years policy when less than a year has expired the reserve is nine-tenths; when the period expired is between one and two years, it is seven-tenths; when between two and three years, it is five-tenths; when between three and four years, it is three-tenths; and when between four and five years, it is one-tenth of the total single premium paid in advance for the five years' risk.

When it appears from the State Returns that the reserve of unearned premiums made by any company is very little above 50 per cent. of the premiums received in the year, this gives a sure indication that the Company transacts scarcely any long-term business; while, if the unearned premiums amount to 80 or 90 per cent. of the Fire premium income, this implies that the Company has on its books a considerable proportion of such business.

The inclusion of long-term insurances in the ordinary accounts, and in the statements of premiums and claims which are widely issued, renders the statistics misleading; and a similar effect is produced by the large advance from year to year in the volume of the business (whether *annual* or *long-term*) with the consequent increase in the unearned premiums. That this is so, not only in the case of individual Companies, but also, in all probability, in the case of the published statistics relating to Fire Insurance business as a whole, in the United States, I think I shall be able to show you.

The chief statistical tables relating to Fire Insurance business which are brought out in the United States are the "Pocket Index" and "Fire Insurance by States." The former, which every agent carries about with him, gives for each Company the premiums received, the expenses, the claims, and certain other particulars, for each of the last ten years. The latter, which is a much more elaborate publication, gives, as its chief feature, the premiums and claims *in each State* for each Company, and for all the Companies collectively; and it is relied upon by Fire Insurance managers as a guide to the profitableness or unprofitableness of the business in individual States. While I freely admit that much labour and care have been bestowed upon these publications, I feel bound to state that from their omission to allow for the effect of long-term policies and of increase (or reduction) in the volume of business, they are often misleading, and their general effect is to show a lower claim ratio than the true one. In the Green Books, issued annually by the New York State Insurance Department, materials are given from which, with some labour, a fairly accurate investigation can be made of the true claim ratio for each Company in each year. The process followed in making this investigation resembles in principle that adopted in a railway-ticket clearing-house for dealing with tickets where the journey has extended over more than one line of railway. There, the object is to apportion to each railway its proper share, regulated by the mileage, of the original price or fare. Here, we have to deal with annual premiums paid in one year which carry on the insurance to some date in the following year; and with long-term premiums paid in a lump sum in one year which carry on the insurance through the whole of the following year, and possibly through several suceeding years. And what we have to do is to apportion approximately to each year its proper share of the premium. If we were able to make the apportionment by days, in the case of fractions of a year, the calculation would be exact and not merely approximate; but the materials sppplied in the Green Book do not admit of an exact calculation for fractions of a year; and we are compelled to adopt the approximation sanctioned by the Insurance laws of the various States, under which, in the case of annual and long-term policies, any fraction less than a year is treated for the purpose of the State returns as if it were exactly half a year. While I have not been able to test the accuracy of this American legal estimate of the proportion of

remium applicable to the year of issue (and outstanding on annual policies at the end of the year) I think it probable that it may be a fair enough estimate, because, in America, annual policies all run from the day of issue to the corresponding date in the following year, and long-term policies all run on a similar plan, so that there is no disturbing effect of term days as at home.

It is important that I should make my meaning clear to all, even at the risk of my remarks appearing tedious to those who have already fully followed what I have said. I therefore think it necessary to explain that in dealing with the year 1900 I assign half of the premium income received on annual policies in that year to 1900, and the other half to 1901. In like manner, in the case of three years' insurances effected by one payment in 1900, I assign one-sixth of the premium to 1900, one-third to 1901, one-third to 1902, and one-sixth to 1903. And in the case of policies for a term of five years effected by one payment in 1900, I assign one-tenth of the premium to 1900, one-fifth to 1901 and each of the next three years, and one-tenth to 1905. I also credit 1900 with one-half of the income from annual policies issued in 1899 and with a due proportion of the income from long-term policies issued in 1899 and previous years, which extend into 1900 or beyond that year.

To have dealt in this way with the figures of all the Companies included in the Green Book would have involved too large an amount of labour to have been overtaken within the few days which I was able to devote to the preparation of these notes, and I was therefore unable to attempt this. But it appeared to me that a sufficient idea of the effect produced by long-term policies, and by the upward trend of the business, could be got by taking out the figures relating to ten prominent American Companies. Of the ten which I selected for this purpose, three belong to the State of Connecticut and seven to New York State. They transact among them more than one-third of the total business done by the whole 128 native Companies reporting to the Insurance Department at Albany, N.Y., and I therefore think that the ratios obtained, collectively and individually, in the case of these ten Companies, may be regarded as fairly representative.

I now submit the figures obtained:—

RESULTS IN THE CASE OF THE TEN COMPANIES TAKEN COLLECTIVELY.

	1899.	1900.
Premiums received - - -	$30,715,000	$33,654,000
Premiums really applicable to the year - - - -	29,479,300	31,236,400
Fire claims - - - -	19,188,800	19,884,000
	%	%
Ratio of Fire claims to premiums received - - - -	62·5	59·1
Ratio of Fire claims to premiums really applicable to the year -	65·1	63·7
Increase in claim ratio by adoption of the correct method of calculation - - - -	2·6	4·6

STATEMENT showing, in the case of the ten Companies taken individually, the INCREASE OR DECREASE IN THE CLAIM RATIO resulting from the adoption of the correct method of calculation.

Company.	1899.		1900.	
	Increase.	Decrease.	Increase.	Decrease.
No.	%	%	%	%
1	1·7	—	2·0	—
2	1·9	—	3·8	—
3	8·4	—	8·7	—
4	2·8	—	4·1	—
5	2·7	—	6·9	—
6	—	6·7	—	2·0
7	7·7	—	7·4	—
8	0·7	—	3·4	—
9	5·5	—	5·7	—
10	4·9	—	7·6	—

It will be observed that No. 6 is the only one of the ten Companies which shows a reduced claim ratio as the result of the correct calculation, and that it shows a reduction from this cause in both years. The reason becomes apparent on examination of the returns of that Company to the Insurance Department, which show a diminished proportion of long-term policies in recent years —a feature which is quite the exception.

One of the ten Companies was organised after 1880, but the other nine had existed, on the average, for 32 years prior to 1880, and for 52 years prior to 1900.

In 1880 the premium incomes of the these nine amounted to 13,246,000 dols., while in 1900 the amount reached 31,701,900 dols., representing an increase of 239 per cent. In 1880 the proportion of unearned premiums to premium income in the case of the nine, taken collectively, was 65·6 per cent., while in 1900 it was 86·9 per cent., an increase of 21·3 per cent.

Taking the whole native Companies collectively, the increase in premium income in the twenty years was 242 per cent., which differs very little from the increase of 239 per cent. in the case of the nine Companies; and the increase on the unearned premiums was 19·1 per cent., namely, from 64·8 per cent. in 1880 to 83·9 per cent. in 1900.

The very close agreement in these ratios for the whole Companies seems to me to inspire confidence in the other results which I have deduced from the figures of the ten Companies alone, and leads me to think that they may be regarded as fairly representative of what might be expected if the United States business of all the other Companies were investigated in a similar way. I therefore suggest that the true claim ratio on United States business in recent years is probably from 2·6 per cent. to 4·6 per cent. in excess of the apparent ratio calclated on the premiums received.

In bringing out the claim ratios on United States business it would have been more correct to have employed "claims incurred" than "claims paid." The former could have been got by taking the claims paid during the year, adding thereto those outstanding at the end of the preceding year. But to have employed "claims incurred" would have introduced another element of discrepancy in a comparison with the unofficial statistical tables in common use in America; and, as I had little time for investigating discrepancies, I thought it best on this occasion to employ "claims

paid," which could be got direct without calculation from the New York State Returns, and could be checked by comparison with the unofficial tables.

It will be observed that throughout these Notes I have used the terms "claims," and "claim ratio," instead of "losses" and "loss ratio." In doing so I have had no expectation of being able to effect a change in expressions which have had the sanction of long-established custom. But it seemed to me that the use of the latter terms, in the sense in which they are commonly employed, might mislead some of our members who are not familar with the nomenclature of Fire Insurance business. In strictness, and apart from usage, the terms "loss" and "loss ratio" can only be regarded as appropriate if used to indicate the outcome of the business when the result is on the wrong side; just as the opposite expressions, "profit" and "profit ratio," are recognised as only applicable when indicating the outcome of the business if it is on the right side. I may repeat here what I indicated in a former part of this paper, namely, that in arriving at the true profit ratio, or true loss ratio, interest on the reserve ought to be taken into account; and I may add that in the case of United States business it would seem fair, for the purpose of arriving at the true profit or loss, to treat the reserve as equal to two-thirds of the unearned premiums (thus deducting one-third for prepaid expenses), and to credit the year's Fire account with interest on such two-thirds.

D. DEUCHAR, F.R.S.E., F.F.A., F.I.A.

Insurance Society of Edinburgh,
January, 1902.

LIFE ASSURANCE INVESTMENTS.

THE subject I wish to bring before you to-night is that of "Life Assurance Investments." I quite feel that it is one with which you are already thoroughly familiar, and I am also aware that it has been treated several times in this Society in a manner much more original and authoritative than is possible for me; but, on the other hand, it is one of the sciences—if the investing of money can be called a science—which develop so rapidly that a thorough knowledge of it cannot be acquired without information brought up to the most recent date. The general principles which guide the choice of suitable investments may remain unaltered, but, as the application of these varies with the circumstances of the time, there will always be room for fresh illustrations of the manner in which they should be handled.

I may say, however, that I have been mainly influenced in the choice of this subject by the instruction to our Society from the Federation of Insurance Institutes to furnish a paper during the current year on Life Assurance Finance from an educational point of view; and while the limits of our time to-night (if there were no other obstacle) prevent me from fulfilling their commands, I have thought it might be well to take up the matter in a superficial way, in the hope that my remarks may induce some of the younger members of the Society to carry out the instruction fully by preparing a more exhaustive treatise.

There is no doubt that such a treatise is much to be desired. The investment of their funds is one of the most difficult, if not the most difficult of the problems Assurance Offices have at present to face, for undoubtedly their existence depends to a great extent on their obtaining a fair return of interest without risk of the funds being lost.

You will probably say that there is a greater difficulty in getting business than in the disposal of the money after the business is obtained; but while from our own experience we all know the stern fight that has to be fought before the year's return of new

business can be completed, yet there are signs that the public is being educated as to the value and importance of Life Assurance, and I think we may look forward to a time when it may not be necessary, as at present, almost to compel people to insure their lives. The position in that respect is probably improving; but, on the other hand, when we consider the question of what is to be done with our surplus funds, we find that the problem is becoming more complicated year by year, in consequence of the increased competition for gilt-edged securities.

The cause of the difficulty may be stated in a few words:—The amount to be invested has been, and is, increasing with rapid strides, while suitable outlets are not increasing in anything like the same ratio—indeed, one or two outlets which at one time were in great favour are now practically closed so far as Assurance Offices are concerned.

To go no further back than twenty-eight years, the assets of British Life Offices, including Industrial Offices, have in the interval practically trebled themselves—having increased from 109 millions in 1870 to 300 millions in 1899. Rapid as this progress has been, that in America has been very much greater. In an address delivered in May last by Mr. T. B. Macaulay, of the Sun Life of Canada, at the opening meeting of the Actuarial Society of America, it is shown that the Offices reporting to the New York State Insurance Department possessed assets in 1869 amounting to 35 millions sterling; in 1900 these assets had reached the total of 315 millions sterling—being nine times greater than in 1869.

Such is the state of matters as regards the sums for which Insurance Offices require to find investments. In order to show that some of the outlets for investment available in the past for the assets of Assurance Offices are, from one cause or another, becoming closed, or at least narrowed, I would refer you to the following Tables:—

[TABLES.

TABLE I.—LIFE COMPANIES OF THE UNITED KINGDOM.

SUMMARY of the total Assets in 1871 and 1899 sub-divided into different classes of Investments, and the Percentages which the amounts in the different classes bear to the total Assets in each year.

Class of Investment.	1871.		1899.	
	Amount Invested.	Percentage to Total Assets.	Amount Invested.	Percentage to Total Assets.
	£		£	
Mortgages in the United Kingdom, ...	50,819,064	46·36	70,703,395	23·54
Mortgages out of the United Kingdom, ...	751,482	·68	11,972,717	3·98
Loans on Policies, ...	5,269,363	4·81	12,463,105	4·15
Loans on Rates, ...	10,194,506	9·30	31,422,649	10·46
British Government Securities, ...	8,214,559	7·49	6,730,844	2·24
Indian and Colonial Government Securities, ...	5,255,753	4·79	18,806,303	6·26
Foreign Government Securities, ...	1,228,494	1·12	10,561,920	3·52
Debentures and Debenture Stocks, ...	10,412,626	9·50	51,165,390	17·03
Shares and Stocks, ...	3,111,277	2·84	34,571,447	11·51
Land and House Property and Ground Rents, ...	4,691,432	4·28	27,067,561	9·01
Life Interests and Reversions, ...	1,689,322	1·58	7,240,691	2·41
Personal Security, ...	1,806,924	1·65	1,413,377	·47
Agents' Balances and Outstanding Premiums, ...	2,396,136	2·15	6,170,757	2·05
Outstanding Interest, ...	776,763	·71	2,767,661	·92
Cash Deposits, Stamps, &c., ...	2,709,013	2·48	6,033,060	2·01
Miscellaneous, ...	283,521	·26	634,349	·21
Deficiencies, Preliminary Expenses, &c., ...	...	...	678,542	·23
	109,610,235	100·00	300,403,768	100·00

TABLE II.—LIFE COMPANIES IN THE UNITED STATES.

SUMMARY of the total Assets in 1869 and 1900 of Offices making Returns to the New York State Insurance Department showing the amount invested in different classes of Security, and the Percentage which the amounts bear to the total Assets in each year.

Class of Investment.	1869.		1900.	
	Amount invested (taking the dollar at 4s).	Percentage to Total.	Amount invested (taking the dollar at 4s).	Percentage to Total.
	£		£	
Cash on hand and in Banks, ...	1,043,676	2·98	13,278,971	4·21
Deferred and Outstanding Premiums, ...	3,376,105	9·64	5,672,070	1·80
Premium Notes, ...	8,521,407	24·33	2,937,444	·93
Loans on Policies, ...	274,666	·78	10,910,371	3·46
Interest and Rent due and accrued, ...	395,242	1·13	3,328,460	1·06
Mortgages on Real Estate, ...	11,603,041	33·13	92,309,599	29·28
Real Estate owned, ...	969,024	2·77	30,388,312	9·64
Collateral Loans, ...	511,873	1·46	10,001,347	3·17
U.S. Government Bonds, ...	5,256,715	15·01	1,870,240	·59
Foreign ,, ,, ...	...	...	6,533,965	2·07
State, City, and County Bonds, ...	2,142,332	6·12	19,018,664	6·04
Railroad Bonds, ...	192,042	·55	93,326,074	29·60
Other Bonds, ...	42,000	·12	9,078,380	2·88
Railroad Stocks, ...	129,099	·37	7,989,487	2·54
Other Stocks, ...	563,533	1·61	8,613,551	2·73
	£35,020,755	100·00	£315,256,935	100·00

The former of these applies to British Offices only and gives the aggregate assets in the years 1871 and 1899 respectively, distributed among the various classes of investment detailed in the balance-sheets furnished to the Board of Trade, and also the percentage which the amount of each class bears to the total. The 1871 figures have been extracted from a paper by Mr. David Paulin on "Life Office Investments," to which I would refer you for other interesting information with reference to investments generally; the 1899 figures are taken from the Assurance Company Returns issued by the Board of Trade in February last.

The information in the second Table has been obtained from the paper by Mr. Macaulay to which I have already referred, and is based on statistics in the Reports of the New York State Insurance Department. It shows the assets of the American Offices arranged under a classification similar to, although not exactly the same as, that in the Table referring to British Offices. The most striking feature in the Home Table (No. I.) is the very great reduction in the proportion of assets invested in mortgages in the United Kingdom. I have no doubt if we could have carried the comparison further back—say to 1860—we should find the contrast even more marked, and that by far the larger portion of British Assurance Funds were at that time lent on security of real property. Unfortunately, the aggregate figures of all the Offices applicable to the years before the Assurance Companies Act was passed cannot be obtained; but taking as a typical example one of the most important of the Offices, I find that in 1866 73 per cent., or almost three-quarters of its assets, were invested in this way. The methods of Offices differed then as they differ now; but I think we may safely say that thirty-five or forty years ago loans on heritable security or mortgages were the mainstay of the investment department of Assurance Offices, and that all other forms of security were merely supplementary.

The position is now quite changed. In the aggregate the amount being advanced on home mortgages is small compared with the other investments made by the Offices—so small, indeed, that it is not sufficient to make up for the mortgages repaid. The following are the total amounts for the years 1891 and 1899 of mortgages in the United Kingdom, as entered in the balance-sheets of the Assurance Offices. The year 1891 has been chosen because at that time the aggregate amount of the home mortgages

reached its maximum, although the proportion to total assets had previously begun to fall.

	Amount.	Percentage of Total Assets.
1891, . .	£74,028,183	36·7
1900, . .	70,703,395	23·5

If you pass for a moment from the figures of the British Offices and turn to the table relative to the American Offices, you will see that the tendency in the United States has been in the same direction. As might have been expected when we consider the different conditions of the two countries, the falling-off has been less in America than in Great Britain, although, as a matter of fact, it has been greater than appears from a comparison of the figures in the table. In 1869 the downward tendency of the mortgage business in America had not yet begun, and, indeed, fully ten years expired before any reduction was experienced. It will be seen from the annexed statement of the amounts and percentages of mortgages on real estate in the American Offices that the ratio to total assets has decreased from 43 per cent. in 1880 to 29 per cent. in 1900:—

	Amount.	Percentage of Total Assets.
1869, . .	£11,603,040	33·3
1880, . .	34,742,065	43·2
1890, . .	54,638,296	38·9
1900, . .	92,309,600	29·3

It is therefore apparent that investment in mortgages as the main outlet for Assurance funds is passing away in both countries. The reason is not far to seek. The amount of trust money and of other funds for which gilt-edged securities are wanted has been increasing with the prosperity of Great Britain, but as the value of land and buildings has not been increasing to anything like the same extent, the demand has grown until it greatly exceeds the supply. It will have been observed that in America the loans on mortgages are still increasing in amount although not in ratio, the fact being that the excess of demand above supply has not reached such large proportions as in this country. With a large portion of the continent still undeveloped to anything like its fullest extent, there is still plenty of property left in America to be mortgaged.

An additional factor in the excess of demand for mortgages doubtless arises from the transfer of private capital on a large scale from industrial undertakings as the result of these having been turned into Joint-Stock Companies. In this way alone enormous sums are set free for which investments have to be found, and by competing in the mortgage market they have accentuated the difficulty.

From these and other causes there has arisen an increased supply of money for which mortgages are wanted, or, in other words, an increased demand for mortgages, with the result that borrowers are now able to command much better terms than previously. At one time the Offices were able to charge from 4 to 4½ per cent., but in late years the rate has dwindled until loans on the best class of property three or four years ago could be obtained at 3 per cent. There has been a slight rise in the rate since then, but I do not think a borrower at present would have any difficulty in procuring a loan at 3½ per cent. if the security is a first-class one.

The natural effect of the fall in the rate has been that the Offices, finding they can obtain securities of an equally good class which bear a better rate of interest, have gradually reduced the amount of their mortgages; and during the last ten years, as I have shown, the sums they have lent amount to less than those repaid.

If you will refer again to the Table of Home Investments, you will see what classes of security have taken the place of mortgages in the United Kingdom. I do not propose to consider the various items in detail, and would merely mention the two outlets mainly adopted.

There is first the item "Mortgages out of the United Kingdom," the proportion of which to the total assets has increased from less than 1 per cent. in 1870 to nearly 4 per cent. in 1899. The securities of this class consist principally of loans over properties in Australia and over house properties in the larger towns in Canada, Australia, the United States, and in the Northern States of Europe. At one time high rates of interest could be obtained —up to 5 and 6 per cent. in Australia and the United States— but latterly the amount of money offering for investment is so great that the difference between the Colonial or foreign and the home rate is rapidly approximating. Such investments are open to the objection that the lender is not as thoroughly conversant

with the security as if it were in his own country, and has to trust to foreign valuers, foreign solicitors, and foreign advisers generally, so that, on the whole, it seems to me that unless an Office has reliable connections in the country where the property is situated, the risk of loss caused by want of proper supervision fully counterbalances any increased rate of interest obtainable.

The second outlet—and much the more important one—consists of what may be called "Stock Exchange Investments," which are entered in Table I. under the headings—

"British Government Securities."
"Indian and Colonial Government Securities."
"Foreign Government Securities."
"Debentures and Debenture Stocks."
"Shares and Stocks."

In 1871 these amounted to 25·74 per cent. of the total assets; in 1899 the ratio had increased to 40·5 per cent. They are made up principally of Home Railway Debenture and Preference Stocks, Home and Foreign Government Securities, Obligations of American and other Foreign Railways, Debenture Stocks of Trusts and Commercial Companies—all of the best class.

At one time, I remember, if the value of a security was likely to fluctuate even to a small extent, it was, on that account, held to be an unsuitable investment for an Assurance Office. This theory was probably one of the reasons for the almost universal preference for loans; but, as we have seen, the Offices having been practically driven from the loan market have had to turn their attention to other securities. At the same time, I rather think our predecessors cannot have had sufficiently in view that the value of loans on real security does sometimes fluctuate (as experience has shown us in Glasgow within the last five-and-twenty years), and that any fluctuation is adverse to the lender, since he cannot receive more than the amount of his debt, and may receive less. I think, therefore, we are entitled to hold that the dearth of loans, although it may at one time have been considered a disadvantage, has in reality proved a blessing in disguise, in so far as it has induced the Assurance Offices to look farther afield.

What our predecessors looked for in the past, and what we all want now, is a combination of the best security with the highest possible rate of interest.

Security is, of course, the main element to be taken into consideration, but it is not the only one. We may invest all our funds in Consols or other Home Government securities, and thus achieve the highest security obtainable; but in that case the rate of interest we earn will not be greater than 2¾ per cent. on our capital (even at present, when such investments are comparatively cheap), and at normal times will probably be only 2½ per cent. Assurance Offices at one time were in the habit of investing in Consols to a moderate extent; but for a long time they have practically discontinued doing so, for we find that in the last Government Return the proportion is only about 2 per cent. of the total assets as against 7½ per cent. in 1891. They have found it is quite possible to have safety without being reduced to accept the low rate of interest which British Government securities yield. Of course, if you go beyond these and the limited number of securities available for trustees (which also return a low rate of interest), you have to run a certain amount of risk; but by careful choice of investments you can ensure practical safety combined with a very much better rate of interest.

I may perhaps mention one or two general rules to be kept in view in regulating the choice of investments. In the first place, great caution should be exercised in their selection. In the second place, the investments should be widely distributed; and in the third, all investments bearing too high a rate of interest should be avoided. I do not need to reiterate the necessity for caution in the selection, but the expediency of distributing the funds of an Office over a large number of different securities may not be so apparent. The advantage gained by distribution is, that thereby the risk of loss is also distributed, and consequently minimised. A Life Office does not assure more than a fixed limit on one life, so that undue loss may be prevented. In the same way there should be a limit to the amount we put either into any one investment or into any one class of investments. I would go farther, and say that it is also advisable that we should not confine ourselves to securities of one or two countries, but that the distribution should include as many countries and parts of the world as provide good securities; for you can now obtain good investments in America and the continent of Europe, as well as in this country and its dependencies. The wholesome advice, "Do not put all your eggs into one basket," may be given to Assurance Offices as well as to individuals; but I would carry

the metaphor farther, and say, "Do not put your eggs into any one kind of basket, but divide them among as many reliable baskets as you can find, whether they are manufactured at home or abroad." When we consider that the return on Glasgow Irredeemable Stock at present prices is £2 19s. 7d., while that on Hamburg Irredeemable Stock is £3 9s. 4d.; that British Consols yield 2¾ per cent., and Prussian Consols 3½ per cent., I think, without rendering ourselves liable to a charge of want of patriotism, we may hold that even baskets "made in Germany" are, for our purposes, in some respects superior to those of British manufacture.

A contributory advantage of making use of wide powers of investment is that often when those of one country are depressed those of another may be buoyant. For instance, about a year ago there was a boom in America and a slump on the continent of Europe. At that time Continental securities of the best kind could be picked up at a low price, while American Bonds were dear. It is quite likely that before long the circumstances may be reversed, and an opportunity will then arise for procuring American securities on favourable terms.

I do not say that even with the greatest care you may not now and then experience loss; but the loss on an individual transaction, when the investments are not only judiciously selected but are also distributed over a large area of securities, will be very much less than the difference between the revenue from a fund invested in such a way, and that derived from a similar fund consisting of Consols or other Trust securities.

Take the case of two Offices, each investing a million—one in Government securities at 2¾ per cent., and the other in miscellaneous investments yielding 3¾ per cent. As the first has a revenue from interest of £27,500 and the second of £37,500, the second can afford to apply 1 per cent., or £10,000 per annum, in writing down its securities and still be in the same position as the former. The actual experience of Assurance Offices, however, proves that the amount of loss on investments is very much less than 1 per cent. I find that in the Government Returns for the last three years the aggregate amount written off for loss or depreciation of securities was £610,000, or at the rate of about £200,000 per annum—which is equivalent to only 1s. 6d. per cent. per annum on the total assets. It is probable, however, that this overstates the loss ratio; for if you turn from the credit

to the debit side of the revenue accounts for the same period of three years, the sum entered as profit on sale of investments or increase in their value amounted during the same three years to £1,061,000—being an average of about £350,000 per annum as against the above deficiency of about £200,000. It has to be kept in view also that in a proper method of accounting any rise in the value of the securities, or any excess market value above their book value, would not be taken credit for until the profit is actually realised by the sale of the security, whereas a fall in the value of the securities should be shown, at least on any occasion when profits are divided; hence there is reason for thinking that while the loss is stated at a fairly adequate figure a large portion of the profit which might be obtained has not been written up. It would appear, therefore, that the Assurance Offices have been able to obtain their high rate of interest without loss of capital. But let us make the calculation as strict as possible, and, ignoring the profit, assume that the average loss will amount to 1s. 6d. per cent. per annum on the assets.

By applying this rate to the imaginary case referred to, the depreciation would reduce the revenue of the Office (No. 2) by £750—from £37,500 to £36,750. It will still have an income greater by £9250 than its more cautious neighbour, and will consequently be much better able to provide handsome profits.

There are, of course, investments and investments. By an injudicious selection a much larger loss than that I have shown would result; but I wish to impress upon you that by judicious selection it is possible to obtain security practically as good as that of Trustee investments yielding a much better rate of interest. It may be of interest to see what is the actual rate of interest earned by Assurance Offices. The following are the figures for the years 1884 to 1899, both inclusive:—

Year.	Rate of Interest per cent., without deducting Income-tax.		
	£	s.	d.
1884,	4	6	6
1885,	4	6	5
1886,	4	5	6
1887,	4	5	1
1888,	4	4	8
1889,	4	4	0
1890,	4	2	4
1891,	4	4	2

Year.	Rate of Interest per cent., without deducting Income-tax. £	s.	d.
1892,	4	3	4
1893,	4	2	0
1894,	4	0	9
1895,	3	19	10
1896,	3	19	3
1897,	3	18	10
1898,	3	18	1
1899,	3	18	3

In considering the question as to suitable investments, it should be kept in view that the rules which should guide an Assurance Office in choosing securities are quite different from those applicable to banking institutions.

In the case of the latter a considerable portion of their liabilities is due at call, and may be demanded at any time. Hence, the banks ought to keep—and generally do keep—a large amount of their assets in such a form as to be available at short notice.

Some figures given in a recent paper read by Mr. Luke Hansard show what precautions against sudden calls are taken by the banks in this country. The total of the bank deposits, including those with the Post Office Savings Bank and the Bank of England, is estimated at £947,000,000. Of this total, about 40 per cent. (£388,000,000) is in the hands of the London Clearing Banks, which hold the following liquid reserves, available on short notice, to meet any panic that may arise or any run on their funds:—

(1) Cash in hand and at Bank of England, £62,472,000, or 16 per cent. of their deposits.

(2) Cash on call and short notice, £49,647,000, or 13·7 per cent. of their deposits.

(3) Investments—£84,628,000, or 21·6 per cent. of their deposits.

Mr. Hansard, reviewing the present position of banking in this country, directs attention to the cash reserves (which, you will observe, amount roughly to 30 per cent. of the deposits). He considers that it would be well if the average of these cash reserves were higher than it is now, and the proportion of investments correspondingly decreased—the holding of investments by banks as compared with available cash being open to the objection that, in

any crisis at which it might be necessary to realise, the price would probably be subject to great adverse fluctuation even although the investments consist of securities such as Consols and railway stocks, which command a ready market.

The position, however, of Assurance Offices is quite different. It is not desirable that they should retain in cash and in bank more than is necessary to meet the current outlay. The revenue of an Office from premiums and interests comes in regularly throughout the year, and should be sufficient to meet the annual outlay. Since the bulk of its liabilities do not mature for many years and its position is not affected by a financial crisis, there is no reason for keeping any large portion of its funds in cash, nor is it necessary to place much weight on the point whether or not a security can be realised at a moment's notice.

You see, therefore, there is, as far as solvency has to be considered, no objection to our tying up the funds of an Assurance Office for several years on the ground of the possibility of the actual cash being required; but there are other reasons which compel us to study the question whether we are to prefer temporary or permanent investments. (By the expression "permanent" I refer to loans or bonds repayable at distant dates as well as those that are irredeemable.)

A proper answer to the question could be given only if we could foretell the future course of the rate of interest on gilt-edged securities; and we have therefore to face it as best we can and endeavour to forecast what will happen by making use of the experience of the past. The problem requires more elaborate treatment than can be given it to-night, but it is so important that I should like to say a few words on the subject.

In 1896 I made some reference to the question of the rate of interest in a paper which I then read before the Society. At that time, I may mention, we had reached a period when the rate of interest was practically at its lowest point, and in order to show the full effect of the fall I had prepared a table of the average rate of interest on gilt-edged securities during the ten years previous. The rise since then has been equally striking, and I have thought it might not be uninteresting to repeat the figures, and to supplement them with the corresponding figures for the five years that have elapsed since 1896, thus giving in a tabular form the average rate of interest on gilt-edged securities for a period of fifteen years.

The average rate of interest in the Table is based upon the return on a number of representative stocks, the market value of which amounted in June last to nearly 150 millions. These stocks were selected from an article in the *Economist* of May, 1895, on the "Appreciation of Gilt-edged Securities," a few mentioned in the article which, for special reasons, were not suited for such an investigation being excluded from the calculation. The securities taken were as follows:—

Liverpool Corporation	3½	per cent.	Stock.	
Manchester ,,	4	,,	,,	
Nottingham ,,	3	,,	,,	
Caledonian Railway	4	,,	Debenture Stock.	
Great Eastern ,,	4	,,	,,	,,
Great Western ,,	4	,,	,,	,,
Do. ,,	5	,,	Preference	,,
London, Brighton, and South Coast Railway	4½	,,	Debenture	,,
Do.	5	,,	Cons. Pref.	,,
Great Central Railway	4½	,,	Debenture	,,
North-Eastern ,,	4	,,	,,	,,
South-Eastern ,,	5	,,	,,	,,
Do. ,,	5	,,	Preference	,,

The market values were taken at the last price in the June numbers of the *Economist* for each year. If it had been the main object of the calculation to find the exact return at any particular date, it would have been right to deduct the accrued interest contained in the price quoted, but as we wish to set against each other the *comparative* values at the different dates, the market value quotations have been taken without alteration.

TABLE III.

TABLE showing as at 30th June during the last Sixteen Years the Average Market Value and the Average Rates of Interest on certain specified "Gilt-edged" Securities.

Year.	Aggregate Par Value of Securities.	Aggregate Market Value of Securities.	Actual Revenue.	Average Market Value of Securities per cent.	Average Rate of Interest.
	000's omitted.	000's omitted.	000's omitted.		
1886	£81,911	£102,353	£3,543	£124 19 0	£3 9 0
1887	82,299	105,503	3,558	128 4 0	3 7 5
1888	84,417	114,542	3,635	135 14 0	3 3 6
1889	92,511	127,141	3,939	137 9 0	3 2 0
1890	93,038	125,900	3,960	135 6 0	3 2 11
1891	94,955	127,267	4,037	134 1 0	3 3 5
1892	96,832	134,690	4,113	139 2 0	3 1 1
1893	97,342	139,469	4,134	143 6 0	2 19 3
1894	99,040	145,805	4,203	147 4 0	2 17 8
1895	98,515	152,154	4,189	154 9 0	2 15 1
1896	101,492	170,533	4,313	168 1 0	2 10 7
1897	108,416	167,263	4,377	154 6 0	2 12 4
1898	109,428	161,921	4,421	147 19 0	2 14 7
1899	110,078	158,786	4,448	144 5 0	2 16 0
1900	110,820	151,485	4,474	136 14 0	2 19 1
1901	113,288	148,389	4,573	131 0 0	3 1 8

It will be observed that in the period comprised in the Table the rate of interest varies from a little less than 3½ per cent. to a little more than 2½ per cent., and that for the first ten years it decreases with comparative steadiness, the fall being broken only by two slight fluctuations—one in 1890 caused by the Baring crisis, and the other in 1893 by the currency difficulties in the United States. The decrease culminated in 1896, when the rate reached its minimum, which was also due to abnormal causes.

The long continuance of a 2 per cent. Bank rate made it possible for speculators to secure a profit by buying gilt-edged stocks with borrowed money, and holding them as long as the rate of interest on these stocks exceeded the rate charged by the banks. When the rise in the Bank rate took place this form of speculation became unprofitable, with the result that gilt-edged securities depreciated in value and the return on them began to tend upwards. This upward movement has since become more marked in consequence of the outbreak of the South African War in October, 1899, and by the contemporaneous development of trade here and abroad. During the five years the average market value per cent. of the stocks in the Table has fallen from 168 to 131—a depreciation of over 20 per cent.; and the average rate of interest thereon has risen from 2½ to 3 per cent.

You will thus see that the rate of interest depends upon the course of events in the political and financial world; and, since we cannot foretell what is about to take place in the latter, it is impossible to say whether the rate of interest in the future will rise or fall. There is, however, a general impression among the authorities on the subject that while we are passing through a period during which the rate of interest is not likely for some time to vary to any great extent, yet eventually its tendency will be downward. Seeing that the market rate of interest on gilt-edged securities was lowered in 1896 in consequence of abnormal causes, and that from the commencement of the South African War it has been abnormally increased, we ought to look for the normal rate to lie between the figures for the years 1897 to 1899 —that is something like 2¾ per cent. For a time, it may be even for some years, we may have a continuance of the present high rates; but under ordinary circumstances I fear that the present opportunity of obtaining investments at a cheap price will not last far into the present century. A European war or a great revival of commercial prosperity might, and would, probably keep up the rate; but it is felt that gilt-edged securities are likely to improve in value when the Transvaal mines again contribute their full quota to the gold supply of the world and the present unsettled feeling which invariably accompanies a period of war is removed.

As already mentioned, I have referred to this subject in order that we may form some opinion as to the relative merits of temporary and permanent investments. Should the prevailing

feeling be correct, permanent investments or long-dated bonds are at the present time to be preferred to investments repayable at early dates. If, for example, you have a bond for seven years which yields $3\frac{3}{4}$ per cent., and if at the end of that period the market rate should fall to $3\frac{1}{4}$ per cent., the borrower in all probability will ask you either to renew it at $3\frac{1}{4}$ per cent. or to accept repayment. You will, in either case, have to submit to a reduction; whereas, if you had invested your money in a bond running for fifty years at $3\frac{3}{4}$ per cent., you will at the end of seven years continue to receive that rate even though the market rate should fall; and, in consequence of the fall, the bond will have appreciated in value.

This preference for permanent investments is, of course, based on the circumstances of the present time. To-day we think interest will eventually be reduced to a lower level than it stands at present, but circumstances change suddenly and unexpectedly, and it is wise always to watch the signs of the times. We hold one opinion to-day, but it is quite possible we may have reason to change it before a year is over. It may then seem advisable for us to adopt a different policy.

In the foregoing remarks I have confined myself to one or two of the points which should be kept in view in selecting investments. An adequate treatment of the subject would require an explanation of the more numerous elements affecting it; but I must leave to some other members of the Society the duty of explaining in full the different classes of investment suitable for Assurance Offices. At one time a consideration of the circumstances ruling the choice of mortgages would have been the most important of the topics which should have come under view; and though, as I have mentioned, the day for investing in that class of security seems to be passing away, yet, as there are still some mortgage loans the special circumstances of which render them more suitable for an Assurance Office than for the ordinary lender, it is desirable that we should have a thorough acquaintance with their characteristics.

In addition to this important subject of study, the large number of securities of a miscellaneous character in which Assurance Offices now are mainly placing their funds require each of them for itself a special knowledge, in which information as to the circumstances of each country, its past history and progress of its trade, the character of its inhabitants, in addition to the facts and

figures concerning the particular investment in view, have to be investigated. You will thus see that the subject of the investment of Assurance funds, though possibly intricate, is one of great interest; and I would commend it to the younger members of the profession as a study which will not only assist in enlarging their knowledge of men and affairs, but will also prove useful in the daily discharge of their duties.

N. B. GUNN, F.F.A., F.I.A.

Insurance and Actuarial Society of Glasgow,
November 18, 1901.

MORTGAGES.

I PROPOSE in the following remarks to bring before you some of the practical questions that arise in connection with mortgages. In treating the subject chiefly from a Life Office point of view, I may go over ground already to some extent familiar to you; but a paper such as this will, I hope, serve a useful purpose in bringing to your notice incidents in connection with these securities that necessarily come more often before a head office than a branch, and it may thus assist the relations between the two sections of an Insurance Company's staff. As a private investor one has not usually the opportunity of becoming so well acquainted with mortgages as with other securities. There are several obvious features that may deter one from investing in them. They are not in the public market like stocks and shares; there may be difficulty in procuring a suitable loan when one has money available, or in realising one's capital at the most convenient time; and there is also the trouble of collecting the interest. Moreover, the choice of a suitable mortgage security often calls for the expenditure of skill and trouble that private individuals may be unable to devote to it. With Life Assurance Companies, however, the position is entirely different. Mortgages have always been recognised as a most suitable outlet for their funds; and one has only to glance at the Board of Trade Returns to see how large a sum in the aggregate is devoted by British Companies to this item in their balance sheets. Yet, though at the present time there are about 80 millions in mortgages, or about 29 per cent. of the total funds, the favour with which they were regarded was even more prominent in the past. Fifty years ago, the proportion seems to have been about four-fifths. These figures admit, of course, of very simple explanation. Where a Company has undertaken to meet such contracts as Life Assurance policies the fixed return of capital in its investments is of primary importance; and there are, besides, several considerations which, while weighing

against such securities for a private investor, would have the opposite effect with a Life Office. Most Companies, from their prominent position before the public, their policy-holders, or their agencies and connections, can easily get a sufficient supply of loans; and their ample funds give them special facilities for selecting the most suitable whenever they may be offered, or for whatever amount they may be required. Then, besides having the machinery for laying out their money in this way, a Life Office can devote to its mortgages the proper care and management that a large number of these securities necessarily requires.

Personal Covenant.

A mortgagee generally relies to some extent on the borrower's personal covenant, even if he is not taking it into account in estimating the security for his capital. If trustees are raising a loan on mortgage, they may offer the security without rendering themselves liable for the debt; or the personal covenant may be entirely disregarded where the mortgagee is able to make arrangements at once for the receipt of the income, or allow interest to accumulate. But in most cases the borrower's position and characteristics are of some weight in the lender's calculations, and to safeguard himself against trouble in the collection of interest and lessen the chance of having to take over the property, the latter adopts the precaution of ascertaining the applicant's social and financial position, and his character and reputation. Where the advance is being made to a business man of good standing, who is borrowing to make the best use of his capital, the prospect of the conditions of the contract being carried out is naturally on a very different footing to that in the case of an impecunious person of independent means trying to raise money to meet pressing necessities. From the former it would be unusual to experience the slackness and unpunctuality so commonly the result of the latter's circumstances and training. Then, too, in lending to a class of persons unused to business, it is sometimes necessary to exercise care to see that the borrower is well advised. A Life Office gets no remuneration by way of high interest for any risks of trouble or loss that might arise by the mortgagor repudiating any part of the contract on the ground that advantage had been taken of his inexperience; and one cannot forget that, however fair and reasonable a transaction might be considered among business men, the sympathy of a jury would not unlikely be against a Company

trying to enforce its rights by an action. If an intending mortgagee has no direct knowledge of the applicant, it is usual to resort to references. Enquiries are often made, as you are aware, through a banker or solicitor, though some people do not attach much value to these. The former, it is said, may know little of his customer's means beyond the banking account, while the extremely cautious reply usually received from the latter seldom adds much to the enquirer's knowledge. But even if one gets no precise information from these sources one can draw an inference that, taken with other evidence, may be of use for the purpose in view. General reputation alone, I need hardly say, is worthless, indeed, often misleading. This is strongly brought out in the case of loans on personal security. One need only have a slight acquaintance with the results of enquiries made as to the position of proposed sureties, which are necessarily of a searching description, to recognise the flimsy basis on which financial reputation often rests.

Questions affecting the personal covenant disposed of, the lender has to consider the security and the terms on which the loan is to be granted. While with the general features of land and house property for purposes of mortgage most business men are acquainted, their special aspects can only be dealt with by an estate agent or surveyor. I propose, however, to refer briefly to some of the former, and, later, to mention the principal considerations to which it is useful for a mortgagee to give attention in employing the services of an expert to value his security.

Land and Houses. Fifty years ago loans on the best freehold land with ample margin seem to have carried 4 per cent.; or, where the amount of the loan was small, even 5 per cent. Competition among trustees and big investing corporations like Life Offices with other circumstances brought the rate down, until a few years back the interest produced by these securities was as low as 3¼ per cent. to 3½ per cent. Loans for large amounts were obtained even at 2¾ to 3 per cent. Interest has of course shown an improvement since the outbreak of the War; but most Offices regard the return from mortgages on this high class of security below the limits at which their funds must be invested; and it is no doubt partly due to the exclusion or some of these securities that the amount now invested in mortgages bears a smaller pro-

portion to the total funds than formerly, as exhibited in the Board of Trade Returns. As to buildings offered for mortgage, freehold blocks of offices in the City of London may perhaps be placed at the top of the scale. The values continually increase, and for many years the demand must tend to maintain the rents. Residences offer a wide variety of choice for a mortgage. Those built for aristocratic or wealthy occupiers are generally less suitable as securities than less pretentious dwellings; for while the value of the former depends to some extent on the vagaries of fashion, that of the latter will be controlled by less fluctuating elements. Large country houses, for example, in some cases may be very awkward properties for a mortgagee to hold. Should the borrower default, the difficulties of finding the person who would want just the sort of luxury the dwelling provides might leave it on the lender's hands for a considerable time; and, unless there is a substantial rent roll attached, the upkeep of such a property might prove disastrous. As a comparatively modern feature, blocks of residential flats are often offered as security for a mortgage. These have been extensively run up in London, with the idea that this form of residence will gradually be adopted in preference to what is, with many people, the only alternative, viz., a suburban villa, to be sought farther and farther from the business centre as population increases. In many cases it is clear that the rents asked are higher than the demand justifies, and it is not an uncommon sight to find building speculations of this description hanging fire in various parts of the Metropolis. As a security there are several obvious objections. Should it be necessary to sell the property it cannot be disposed of in small lots like land or houses, and purchasers able to acquire a large block of buildings are sometimes not so easily found as those who would take up small property. Then there is the question of management to be faced by a mortgagee who may have to go into possession. One objectionable tenant may affect the total rental to a much greater extent than in the case of separate houses; and as the tenants are less permanent than in other classes of property, they must be more closely watched. In the fashionable quarters of London, too, the rentals may be subject to the unsatisfactory fluctuation sometimes occurring in other high-class residences. Properties subject to weekly rents are not at all favourably regarded by Life Offices, whether in the form of tenements in the crowded parts of the Metropolis, or in separate

dwellings spread over acres of land in suburban districts. As an investment for purchase, I am told they are good properties for anyone who can give very close attention to their management, returning a high rate of interest on the capital; and, moreover, provided defaulting tenants are turned out at once, the investment shows a well-sustained income, as a dwelling seldom remains unlet in a locality where the demand is practically permanent, like the East End of London.

Applications for loans on licensed premises were very numerous a year or two ago, when the well-known desire of the big breweries to secure tied houses created a boom in the value of this class of property. From the nature of the competition the license was often the principal element of value. Recently, however, there has been a marked falling off in prices, and the loans that often accompanied changes of ownership are not required to the same extent. A feature often put forward as an attractive one was the backing of a second mortgage to be held by the brewer, perhaps a third by the distiller, both of whom got, or expected to get, substantial profits from the trade, and could therefore afford to take much greater risks than the first mortgagee. In a recent action of some interest it was decided in the House of Lords that on redemption of one of these mortgages the mortgagor was released from his covenant to buy the mortgagee's liquor, although the latter contended that it was part of the consideration for their loan that such a covenant was to continue.

Mortgage Guarantees.

The last-mentioned class of property is sometimes offered for mortgage purposes, coupled with a policy in one of the Guarantee Societies. With such an addition, premises subject to a trade risk are often brought within the range of investment of some who would otherwise consider such properties outside their limits. Borrowers as well as lenders have benefited by this extension of Insurance business. Besides trustees, Life Offices occasionally accept these guarantees, so that it may be useful to mention some of the conditions under which such a policy is held. As part of the basis of the contract the Guarantee Companies require, of course, a formal proposal. In respect of this it may be remarked that, whereas the acceptance of a risk is frequently obtained by the borrower before any lender is approached, the latter, as "the assured," will have to see that the policy refers to a proposal

containing the terms and security as finally agreed upon. The premium depends upon the nature of the security and the margin of value. Hence the guarantors as well as the lenders want a surveyor's valuation; but though in some cases each might prefer to employ a valuer of their own choice, for their points of view are not quite the same, it can often be arranged for one report to serve both parties. So far from mortgage guarantees being of the simple nature one might imagine from a superficial acquaintance, they involve a number of questions requiring very careful attention if the policy is to provide the protection paid for by the assured. This is strikingly brought out by the fact that in the policy granted by two of the principal Guarantee Companies there are 16 conditions, some of them lengthy, to which payment of the policy-moneys is subject; and as each of these has, of course, to be kept in view by the assured, his position as a mortgagee, though improved in other respects, is hardly simplified by the ownership of such a policy. Moreover, circumstances may easily arise that are not covered by its terms; in which event the mortgagee has always to bear in mind that there is a third party to be considered, and deal with the mortgagor only with the guarantors' consent. To have, therefore, the sense of security held out as one of the advantages of these guarantees, it is evident that a mortgagee must exercise great care that no act or omission of his gives them the right to void the policy.

Interest is paid by the guarantors when it is in default for 30 days or two months, there being an express stipulation that the lower, and not the penal rate, is to be payable by them. On six months' notice, both the Companies can put an end to the policy by paying the sum assured: otherwise, subject to the payment of the annual premium, the policy runs on for six years in one Company, while the other reserves to itself the right to cancel it at any time on nine months' notice. Fire insurance, ground rents, or other payments to keep the security in force have to be attended to by the mortgagee as if no guarantee existed.

On the power of sale arising under the mortgage, the policy becomes a claim, though the moneys are not payable until *after* the expiration of six months' notice from the assured. One Company stipulates that intimation that such power has arisen must be given within 14 days. There are several important conditions to be noticed in respect of a claim. At any time after it arises, and without prejudice to its payment, the assured is at

the request of the Guarantee Company to proceed to realise the securities; so that a lender is not necessarily free from a troublesome security so soon as might perhaps be supposed. Alternatively, the guarantors can call for a transfer of the debt, and deal with the property independently of the assured. Another condition which should, I think, receive particular attention at the time the loan is granted, provides that before payment is made under a policy the assured must show title to the premises. The effect of this is that under the ordinary policy the guarantors could refuse to accept the mortgagee's title; so that the latter is not at liberty to exercise his discretion in respect of faults, or his policy might be vitiated. Unless the title is of the clearest possible description, it seems advisable to have the policy drawn to cover guarantee of title, which may then have to be investigated by the guarantors' solicitors as well as by the mortgagee's; the expense, with any additional premium that may be payable, being of course borne by the borrower.

Valuation. Mortgagees in the position of a Life Office seldom lend on land or buildings without a report and valuation by a surveyor. In the preliminary negotiations, however, a rough indication of the value of the property can generally be gathered from other sources. The applicant furnishes an estimate, which usually requires to be reduced to meet the views of the lender; and the price at which the property last changed hands is often some guide. Where the borrower is wanting to raise the largest sum possible, and thinks he has bought the property cheaply, sometimes he objects to disclose the sum he is giving. But although the cost to him may, as he alleges, have been below the market value, most lenders would insist on having this information, and would give it due weight in their consideration as to margin.

To get an opinion that can safely be relied on, it is usual to choose a surveyor whose experience in the particular class of property in question is known to be extensive and sound. Should the proposed security be in the country, a person is sometimes employed on account of his local practice, but whether this is the safest course to adopt depends on the circumstances of the case. Speaking generally, a London valuer, or someone from one of the provincial cities, is to be preferred, because the local surveyor, in a small place especially, may, without the lender's knowledge, be

under the influence of the borrower—perhaps his estate agent, or in some other way interested in the security,—and there is therefore a chance of his opinion of the security being biassed. Again, property in new countries, like our Colonies, may be taken as an example where the opinion of local valuers alone may not necessarily be the best from an English mortgagee's point of view. During an active boom in values they would probably be inclined to give less cautious estimates than would be given by a man who would take a wider grasp of the situation and prospects. Of course, in the case of a Life Office doing a large business, these questions do not arise to the same extent as with private lenders. The former generally find it advisable to employ the same firm for most of their mortgages; thus getting the advantage of dealing with persons whose skill and experience they have personal knowledge of, while, at the same time, the surveyors will become well acquainted with their clients' requirements as regards security.

In a report for mortgage purposes the market value is generally given, though a safe and conservative view of the conditions affecting it is adopted. Thus, if the market value is temporarily high, or the situation of the property may be adversely affected in the future by adjacent building operations, the mortgagee would naturally expect the surveyor to point out such circumstances. Besides stating the value, it is usual for the surveyor to include a recommendation as to the amount that can safely be lent; and trustees are only protected, in the event of future loss by depreciation, provided they have acted on advice of this sort. But with other lenders the case is different. There may be special circumstances in which they may prefer to adopt their own view as to the sum they will advance, though the surveyor's opinion as to the amount of the loan may always be usefully included as an element in their calculations. Again, it is important for a mortgagee to know whether the property is readily saleable, so that the value assigned to it could be realised without difficulty or delay, and what are the prospects of maintaining the present income. Rental and out-goings have also to be carefully considered by the surveyor, and his clients advised of any special points in respect of them that might affect the security. Thus, while the former may be fictitiously high and liable to reduction on re-letting, the applicant's statement of repairs and management expenses, which may be only an estimate,

is sometimes considerably less than a prudent mortgagee would assume. Then a lender would wish to be informed by the surveyor of unfavourable features, faults in construction, or necessary repairs; and sometimes recommendations as to the way in which the proposed security might be improved for mortgage purposes, or dealt with if it should fall in hand, may usefully form part of the report. Besides all this, the mortgagee requires to be furnished with an exact description of the property and particulars of its dimensions, in order that he may know what he is actually relying upon, and have it subsequently identified with that to which a title will be shown to his solicitors. The surveyor's fee has to be paid by the applicant. But the mortgagee always stipulates that the surveyor should be instructed by himself, and the report is his property, though sometimes the question of its ownership is raised by the applicant if the loan does not proceed and the latter wants to try to get the money elsewhere.

Reversions. As you are aware, some Offices have devoted a good deal of attention to Reversions. For various reasons these may be considered desirable investments, whether for loan or purchase; for competition for them is restricted as compared with many classes of property offering equal security, and consequently a higher rate of interest can generally be obtained. For many private investors they would be inconvenient securities to hold. Besides the speculative element involved in the uncertain date at which they may be realised, there is the further disadvantage that they produce no income to meet interest on the loan or purchase money; and then, too, there are the technicalities requiring actuarial knowledge for their treatment. While these features would prevent a large section of the investing public from dealing with reversions, they do not of course similarly weigh with a Life Office. The nature of its liabilities allows of the bulk of its funds being locked up for long periods; and, instead of annual interest, it can, if necessary, afford to wait for the equivalent deferred payment. Moreover, the professional skill required in calculating the values is always available; and, as a further attractive feature, there are often policies attaching to these reversionary transactions. On the other hand, one cannot overlook certain unsatisfactory aspects of this class of security, of sufficient prominence to deter some Companies

investing their funds in this direction. Reversionary business, it must be admitted, absorbs a good deal of time and trouble, and when the transaction is small the work involved certainly seems out of all proportion to the profit. Formerly the favourable terms on which these interests could be secured was some compensation, but they hardly offer the same inducement nowadays.

In arranging these transactions it is not at all uncommon to experience some difficulty in getting from the reversioner a full and accurate description of his interest. As a result, although the best means may be taken to come to a clear understanding of the actual security, one often finds this eventually turning out materially different from that put forward in the first instance, requiring a revisal of terms. When one considers the number of ways in which a reversioner may be interested in a fund, this is perhaps not surprising. As an illustration I propose to refer briefly to some of the varieties one may come across. Take the case of the Absolute Reversion, for instance. As against the most common example, where the reversioner has a vested interest on the death of one person only, the reversion may be payable on the death of the last survivor of two or more lives; or the life tenant, who may be a lady, may have the power of conferring a life interest on any husband who may survive her; or there may be circumstances like the following, which are less rare than one might suppose, and I think worth describing, as a complication one may come across.

Suppose A, who is entitled to an absolute reversion on the death of B, predeceases the latter, and leaves his expectancy with other property to be realised and reinvested. By his will A gives to C a life interest in the invested proceeds, which after C's death are to go to D absolutely. Although A's executors may have no discretionary power to retain any of the investments, it sometimes happens that they overlook this, and, omitting at the testator's death to sell his reversion, allow it to stand over pending its realisation on the death of B. D is led to believe that on the death of C after the death of B he will come into the whole fund. This is, of course, not so. C should have had a life interest in the proceeds of the sale of the reversion; and as he has been kept out of his income by the retention of the reversion unsold, the fund, when it falls in, will have to be apportioned to provide a sum in respect of C's postponed life interest, and the balance only

will go to reversioner D. Thus, suppose 20 years to have elapsed since the testator A's death; then, out of a fund amounting to say £1000, the reversioner D will get only £554 and the life tenant C £446. Of such a serious diminution in the value of his interest, the reversioner, sometimes even his solicitor, may be unaware when the transaction is put forward.

In practice, one might get the impression that nearly all reversions offered for loan or sale by private contract are dependent on the lives of persons in feeble health. So at least the agent's information would lead one to believe. But, unless there is strong evidence on this point, the actuary regards the life tenant as a long liver, like other persons of the annuitant class; and in valuing these interests employs a standard table showing a light mortality. The Carlisle table has been largely used. As, however, the recent results brought out by the Institute of Actuaries show the longevity of annuitants to be still more remarkable than was anticipated, a more stringent basis of valuation is required than the old well-known standard. At the same time, the self-selection exercised by the purchasers of annuities may have a much more favourable effect on their expectation of life than the selection against the Office purchasing reversions; and where such interests are being borrowed on, rather than sold, one might look for even a heavier death rate.

Contingent reversions are even more varied than Absolute. As compared with the simple case where the reversioner's interest is subject only to his surviving the life tenant, there may be a number of lives involved, or the reversioner may have to survive a specified term before his interest become vested. Sometimes there is a contingency of a more uncommon sort. Further issue to the life tenant, or some other person, may defeat or reduce the reversion; or there may be a special provision in the will that if the beneficiary fails to assume or afterwards drops the name and arms of the testator, or perhaps on his changing his religion, or, it may be, on his acquiring other property, the estates shall pass away from him. Whatever the contingency may be, the reversioner's interest covered by a policy has a present value that can generally be dealt with; though, after allowing for the premium, the sum in reversion has necessarily a smaller value than if the interest were vested. For instance, the value of an absolute reversion expectant on the death of a lady aged 60, say about 50 per cent., would be reduced to 40 per cent. if a person from 25 to

35 should have to survive her. Though the terms for a loan on a contingent reversion may be calculated on fair and moderate principles, they often sound onerous to the borrower, whose views it is at times difficult to meet. As regards the necessary policy, for instance, one is often asked to take a sum but little in excess of the advance, whereas it is in most cases necessary for a lender to have an insurance equivalent to the sum in reversion necessary to cover the loan. Should the borrower default, premiums and interest will have to be provided by the lender if he holds the security, or by the purchaser, if he sells it; and the accumulations of these payments, as well as the principal, will have to be met out of the policy, if the reversion is defeated by the happening of the contingency insured against. In the case of a Reversionary Life Interest the policy bears a still greater proportion of the amount advanced. A survivorship assurance is not sufficient, but a whole-life policy must be effected. Taking the ages just given, the annual reversionary charge to be sold in consideration of £1000 paid down would be about £213; the purchaser having to set up a policy for £3000 at a premium of about £61 per annum to protect himself. As you are probably aware, loans are seldom arranged on reversionary life interests. The immediate annual cost that would be thrown on the borrower while he is receiving no income would generally be beyond his present means, and to obviate this objection it is usual to deal with these interests by way of purchase of a fixed annual reversionary charge; which has the effect of throwing into reversion the premiums and interest that would have to be met while the interest remains an expectancy, thus relieving the reversioner of any payments until he comes into possession of his income. The transaction being a purchase, the insurance is entirely a matter for the purchaser. A policy may or may not be set up by the latter, but to avoid complications it does not appear in the deed.

While on the subject of reversions I should like to refer to the system under which the reversioner, while selling his reversion, retains the right to repurchase it within an agreed period. As he is under the arrangement allowed to benefit by the early death of the life tenant, it suits some cases better than a sale outright. Moreover, this option plan frees the Office from some of the troublesome operations that usually ensue on the reversioner's failure to meet his interest under an ordinary mortgage. Persons raising money on their expectant interests have seldom much

present income, and when a loan is granted them it is not at all unlikely that sale or foreclosure will have to be resorted to at an early stage unless some satisfactory arrangement has been made at the outset to obviate this. Yet one cannot overlook the fact that this scheme is not regarded so favourably among Offices as formerly. It is said that some Counsel have raised doubts as to the Company's right to absolute possession of the reversion on the expiry of the term, in view of the legal maxim, "once a mortgage always a mortgage," although against this it must be remembered that the validity of the form of the transaction as a purchase has been based on legal opinions of weight taken from time to time by the Offices that have for many years employed the system. As a practical objection, it seems to me that, however clear the Company may be as to the nature of their contract, very frequently it is difficult to get the reversioner to understand it as fully as is desirable for the sake of entirely satisfactory relations. At the time he raises the money he probably hopes and intends to repurchase his reversion within the term, and consequently in his own mind regards it as a mortgage. The sum to repurchase is sometimes stated as so much, with 5 per cent. interest (or whatever the rate may be), but with the object of keeping out even the suggestion of the loan element, to which the use of the term "interest" might give rise, it seems preferable to specify fixed capital sums required to repurchase the reversion at the end of specified periods. Both loans and purchases on the option system are free from one characteristic feature of purchases outright. Under the latter arrangement, if the reversion should fall in soon after the purchase, it is not at all unlikely that the reversioner will think that the Office is getting a large profit in which he ought to share; and he will probably consider himself badly treated when the purchasers refuse to give up part of their gains. He forgets that they have to set against this profit the numerous cases where the life tenants show the most obstinate refusal to permit the realisation of the reversion.

In mortgages of reversions, as the security has to be taken in an entirely different form from that employed in classes of property more generally dealt with, it may be useful to mention some of the special features. The mortgagee cannot of course hold the deeds of title to the estate or the securities in which, through the borrower, he is interested. In most cases these will be in the hands of trustees, to whom, to complete the security, it is essential

to give notice of the mortgage. And as the rights of encumbrancers are regulated by the priority of date of their notices, it is necessary, after an inspection of the deeds or securities to confirm the estate or fund as represented, to inquire of the trustees as to what, if any, notices they have already received. The importance of accurate information on this point is obvious. Should it subsequently prove that they have in their reply misled the lender as to previous dealings, the mortgage may prove worthless; and though he may have a remedy against the trustees personally, that may be a poor substitute for the security he was relying on; moreover, should they have taken the precaution to disclaim liability as to the correctness of their information, the lender could take no proceedings against them. In addition to obtaining information as to prior encumbrances, a mortgagee has to minimise as far as possible the chance that when the reversion falls in the trustees will not employ the money for their own use, or, neglecting the notice served on them, pay it over to the reversioner. The position and character of the trustees have therefore to be considered; and as the risk of defalcation is increased where there is only one, most Offices refuse to deal with a reversion in such a case until another trustee has been appointed. There is another safeguard seldom neglected. When the fund consists of stocks and shares, protection of some value can be obtained by placing a distringas on the investments. This takes the form of a notice served on the Companies in which the stocks are held, restraining them from allowing a transfer without warning the lenders. By this means the latter not only prevents the fund being dealt with on the death of the life tenant without his knowledge, but gets intimation of other circumstances affecting his interest in the trust estate. Thus, on proposed changes of investment the mortgagee will receive warning as the result of his distringas; or the appointment of a new trustee will be brought to his notice, when he can at once take action, if necessary, to see that a suitable person be chosen. It frequently happens, however, that the fund is so invested that these means of protection cannot be adopted. Should it consist of mortgages, for instance, a dishonest trustee could deal with the proceeds without the reversioner's mortgagee being aware of what was going on; and for this reason a reversion to a fund consisting entirely of mortgages is not so good a security as such an interest in stocks. Sometimes the fund is in Court, and then the lender

relies on a stop order in place of a distringas. It may be mentioned that in the case of small loans distringases often prove relatively rather a serious item of expense. The charge for each is generally 2 guineas—sometimes 3 guineas—and the cost of placing a restraint on four or five stocks, to be met by the borrower, not only on the granting of the loan, but also on any change of trustee or investment, will naturally be regarded by him with considerable disfavour.

Investigation of Title.

Though no attempt is made here to deal with the legal aspect of mortgages, a brief reference may be permitted to a few of the circumstances that arise in connection with the employment of the Company's solicitor. Safety of capital being a primary consideration, a Life Office can seldom take such risks in title as lenders with different responsibilities are sometimes prepared to run. Interest, or other profit, may be an adequate remuneration to the latter, but a Life Office, like a trustee, is content with a smaller return, insufficient to provide any consideration for the risks in question. Further, its loans are seldom temporary, but generally for long periods. The legal safeguards must, therefore, be as complete as possible. Greater responsibility is thrown on the Company's solicitors than in the case of some other lenders; and special skill in conveyancing and a thorough acquaintance with securities of a varied nature must certainly be available to protect a Life Office's mortgages. Among the arrangements left to the solicitor, one of no small importance consists in identifying the property on which the company has agreed to lend with that to which the borrower is entitled according to the deeds. In many cases this is simple, but where the estate is large, and cut up into small holdings, the process may involve a good deal of time and trouble. The solicitor collects the best evidence he can procure in the way of schedules, plans, and declarations; and the mortgagee has to decide whether he will accept it. Then the borrower's title has to be examined to see if there are any flaws in it. This is generally required to be done more thoroughly in the case of a loan than in a purchase; for in the latter the purchaser may be willing, for the sake of holding the property, to take it on a title that is not absolutely clear, but is good enough for his purpose. On the other hand, a mortgagee has no inducement to adopt a similar view. The possession of the land has no attractions; he wants the security with such a title as will enable

him to sell it without difficulty. Sometimes a purely technical defect may be allowed to pass, if there is no practical risk of the security being depreciated by the chance of purchasers demurring to accept the mortgagee's title. Take, for instance, the case of the length of title. In this respect a loan differs from a purchase; a mortgagee not being bound by any limit in his requirements. Yet he will often be satisfied with a short title, especially when it commences with a conveyance or lease from a well-known landowner, say one of the great London freeholders, or a corporation. As regards the mortgage deed, you may have noticed that a more formidable document is prepared for a Life Office than some classes of lenders require. Slap-dash arrangements would often suit the mortgagor better. But the lenders have future, as well as present, circumstances to consider, and have to provide for events that may unfortunately happen even in the case of the most sanguine borrowers.

Land Transfer.

One sometimes hears the complaint that under the present system of conveyancing, dealings with land are troublesome, lengthy, and expensive; and that the separate investigations of title that have generally to be repeated at each transaction should be obviated. Land, it is said, should be transferable like Consols. With this end in view, compulsory registration has been introduced, and is now in force in London (except the City); its extension to other counties being contemplated. The ideal aimed at seems to be to provide that titles shall be investigated once for all by a Government department, a certificate granted, and then you can deal with your property like stock. Unfortunately there is this essential difference between land and stock, that possession of the former is, as you know, often complicated by interests of freeholders and leaseholders, and questions of boundaries, rights, and restrictions, that cannot possibly occur in the latter; with the result that, at present at least, the reform appears to have turned out anything but a boon to the public. Titles are largely a matter of evidence, seldom affording absolute proof, but under the old method accepted as good enough when shown to be practically conclusive to reasonable minds. Frequently the best title that can be shown is considerably short of decided evidence. Now, if a Government department is to grant a certificate that a person is *absolutely* entitled to some property, obviously it must

have very much more evidence than is ordinarily accepted. As a result, the expense, time, and trouble involved in its investigation would in most cases greatly exceed that incurred under the old conditions; and it is unlikely, except in the case of very simple titles, that anyone, if he could help it, would pay the penalty of first registration. For twenty-five years voluntary registration has been in force; and some of those laymen, I am told, who have been attracted by the idea of having their titles registered, have had anything but pleasant experiences. To get over the difficulties that would be met in so many properties, the Land Transfer Act of 1897 provided that owners of land could register in three different ways: with an Absolute, a Qualified, or a Possessory title. Those who did not wish to face the expense and trouble that might be incident to registering under the first two, might, by producing their conveyance, and showing that they were in fact in possession of the property, get a Possessory title certificate. In a Government department one hardly expects to find some of the qualities most prominent in successful commercial undertakings, but the former can generally produce something admirable in the way of forms, and although these may not always be so elastic as ordinary business methods, they must prove of great advantage to a department that can make the public conform to its cut and dried system. The Possessory Certificate is worth describing. The front is principally taken up with an elaborate floriated border with the coats of arms of some of the Lord Chancellors, the remaining space containing the following statement:—

"This is to certify that the within named A. B. is registered "as Proprietor with a Possessory Title of (say) the Leasehold "Land known as 1 and 2 John Street comprised in the title No. "40,000 in the Parish of Kensington in the County of London. "Copies of the Entries in the Register and of the filed plan of "the land are within. Dated 1st January 1902. *Note.*—Sec. 8 of "L.T.A., 1897, requires this certificate to be produced to the "Registrar on every entry in the Register of a disposal by the "registered proprietor of the land, and on every registered "transmission or rectification of the Register, but not on a "transfer under a power of sale conferred by a registered charge."

On the next page is a copy of the Ordnance Survey plan, and then there is a sheet containing a description of the property.

Supposing it is leasehold, the land affected, the date of the lease, the parties, the term, and the rent are given. The proprietorship register follows, having entries such as this:—

31st December 1901. Possessory Title Register Proprietor A. B., of

And the last page of the certificate contains a register of charges, giving particulars of date, amount, interest, and name and description of proprietor.

On a Possessory Certificate there is a warning that it is not to be taken as evidence that the registered holder's title is good. The title deeds must still be kept and investigated on each dealing as before; so that with such a certificate you cannot transfer land quite so easily as stock. After 40 years, it is said, this Possessory title will become Absolute, though, in cases of leaseholds, deeds will apparently have to be kept for reference, as the covenants will not appear on the certificates. Under this arrangement of modified registration some authorities think there are great facilities for fraud, enabling the certificate to be dealt with in one quarter and the deeds in another. Now, to get a practical insight into the working of the Act, it is most instructive to observe the results of the two years 1899-1900. (For the figures and some other information on this subject I am indebted to a most interesting paper read by Mr. J. S. Rubenstein before the Oxford meeting of the Incorporated Law Society.) Out of 14,320 titles registered during these two years, 14,273 were under Possessory, and 40 under Absolute titles. Recall how long a difficult title sometimes takes to investigate, even when you may be able to use pressure on your solicitors, and try to imagine a Government department, with all its red tape, and without the stimulus of competition, working through those 14,273 cases with the view of granting Absolute Certificates! Then, again, it is useful to notice, as bearing on the popular comparison of land with Consols, that the Act contains 280 rules; but, so far from these being sufficient to cover the almost unlimited number of questions arising in connection with land in countries like this, fresh ones have continually to be made to meet the complicated points not provided for in the Act. As to the effect of the Land Transfer Act on mortgage business, it seems to me that the advantages to be derived at present from the "reform" are minimised to a great extent by the fact that so few titles are registered as Absolute.

If dealings with land were really facilitated and cheapened, mortgagees as well as mortgagors would benefit, because the latter, having to meet a smaller outlay in raising the money, could afford to pay a slightly higher rate of interest. But, with Possessory Certificates, titles have to be investigated as before, and in addition to the cost of this, the borrower has to pay the charge for putting the mortgage on the register. Further, the value of searching the official records for prior dealings is discounted by the fact that charges granted before the registration with Possessory title will not be disclosed, nor will subsequent incumbrances where the parties have not registered. The statutory form of charge, indeed, is extremely short, a convenience that will be appreciated by both sides; but then it must be remembered that the reforms that have been effected from time to time by improving the old system went a long way in that direction; and the mortgage deed to which we have been accustomed within the past 20 years, as the result of the Conveyancing Act of 1881, has been cut down to an extremely concise and convenient form. I should hardly have presumed to touch on a question so highly technical as Land Transfer, except to try to indicate that under the conditions under which land is held in this country its transfer must necessarily be very different from the simple process required for many other kinds of property, and that, as a fundamental part of the new system, there is the very dubious advantage of having to go through a lot of formalities with a Government department. One of the stock arguments in favour of the system is, that it is worked in other countries. In new countries like Australia, New Zealand, and Canada, one might expect it to be most suitable to the conditions of population and proprietorship of land, though the United States, I believe, is not at all a happy example on the same side. There the difficulties of search are said to be so great that title guarantee Companies are largely resorted to. Again, in such an old country as France, where registration is worked, so far as I can learn, the transfer of land is certainly not facilitated. Their land system is, of course, utterly different from ours, the bulk of the properties being of extremely small value; and registration being coupled with private investigation, the charges, in proportion to the sum involved, are enormous. Experts seem to agree that the trial of compulsory registration in London during the past three years has shown that reform must be on other lines than those that have been attempted; and it is

important that the County Councils, who have the power of electing whether it shall be applied in their respective districts, should be well aware of what the new machinery may involve. (*See* Appendix.)

Mortgagee's Remedies.

Questions are continually arising, where a large mortgage business is transacted, as to the custody of the tenancy agreements. In strictness these should always be handed over to the mortgagee with the other documents of title, and retained by him in case he should require to deal with the property. Should he have to go into possession, numerous difficulties might arise if he was without evidence of the terms on which the tenants were in occupation; or if the property is sold, the purchaser would be in a similar position for want of the documents in question. But cases sometimes arise when the mortgagor asks to be allowed to retain the agreements. When the tenancies are very numerous, and frequently changing, the management of the property by the mortgagor would be greatly hampered by the necessity for constant reference to the mortgage for inspection of the terms of the tenancies, and some arrangement is necessary to obviate this. Copies of the agreements will often assist the mortgagor, but sometimes he is allowed to retain the originals on giving an undertaking to deliver them when required. To the latter course there cannot be much objection, when the general position of the borrower is satisfactory.

Should the borrower fail to carry out his covenants under the deed, the mortgagee has to resort to proceedings that, being principally of a legal nature, are left to a solicitor to carry out. Yet, although the mortgagee need not enter into the details of the technical work, he has from time to time to make himself acquainted with the legal position as presented to him by his advisers and to understand the nature of his remedies, so that he may decide as to the course he will instruct them to adopt. On default occurring he can either sue the borrower on the latter's personal covenant, or he may deal with the security in various ways. A mortgagee can go into possession of the property, receiving the rents, paying the outgoings, and managing the property; but in such a position he has to account to the mortgagor and often to other parties interested in the equity, and this measure is therefore generally a temporary one pending other

courses where there is not the responsibility referred to. The chief aim of most lenders would be to get rid of the security as soon as possible; to which end arrangements would be made for a sale, either by auction or private contract, whenever it could be successfully carried out. If the property is not such as can readily be disposed of, it may be advisable to appoint a receiver. There are several advantages of such a course. The security may be of such a nature as to require its management by a person with qualifications the lender may not possess; and, further, although appointed by the mortgagee, the receiver is deemed to be the agent of the mortgagor. Another remedy is foreclosure. To effect this, the mortgagee starts an action, making all those interested in the equity of redemption parties to it; and after the expiry of a term, generally six months, he becomes entitled to the property absolutely, unless some one of the parties mentioned has come forward in the meantime and paid him off. He is clear of the loan, but is left with the property on his hands, and the proceedings being often tedious, troublesome, and expensive, foreclosure is not so often resorted to as other courses. Absolute possession of the security is sometimes obtained with greater facility by purchasing the equity of redemption. Fortunately, if care is exercised to exclude unsubstantial borrowers, it does not often happen that a lender, even with a large number of mortgages on his books, is troubled with the operations to which I have referred. Now and then, however, a loan in default may absorb time and attention that certainly seem out of all proportion to the remuneration obtained by way of interest, even though a penal rate is charged, and the investment compares unfavourably with those in which there is no occasion for such an expenditure.

In these remarks I have touched on a few only of the many questions that arise in connection with mortgages. It might be interesting to examine the practice of other classes of lenders such as banks, or, to go further afield, the custom in foreign countries. The historical aspect of mortgages, too, would offer ample scope for investigation; while, as regards their legal side, there are, as you are probably aware, ponderous volumes awaiting the research of those who like to take it up. On the present occasion, however, without dealing with these sections of the subject, I trust I have brought before you some of the points that are of the most practical interest and concern to Insurance men.

APPENDIX.

Land Transfer Act.

Since the above was written, a further twelve months' experience of the working of the Act is available. The results, so far as I can ascertain, do not remove the objections to the system held by a very large section of expert opinion. Indeed, as will be seen from the following extracts from the last Report of the Land Registry, the Registrar himself recognises that the present state of things is very unsatisfactory, and that unless some of the present drawbacks are soon removed, the extension of the system may be seriously interfered with, and even the continuance of the work in the original county itself imperilled. These contingencies are naturally of great concern to the large and expensive staff engaged on the Registers; and important changes will no doubt be made not only as the result of the department's zeal for the public welfare but to safeguard its own employment. The paucity of Absolute Titles forms the principal subject of the Registrar's remarks. In respect of this serious feature of the system, it may be mentioned that the results were foreseen by its opponents; and the want of appreciation of the benefits of the Registry by land owners, given in the Report as one of the causes of the small number of such applications, was as pronounced when registration was optional, as since the present Act came into force in 1899.

The extract is as follows:—

SUGGESTIONS FOR REGISTRATION OF ABSOLUTE TITLES.

Registration with possessory title is really only the *first stage* in the process of reform which the Land Transfer Acts are intended to effect. The second, and only complete and final stage, is absolute title.

Possessory title has certain immediate advantages, especially as regards security from fraud, which should not be lost sight of, but it is only in virtue of its ultimately becoming absolute that possessory registration has a value commensurate with the labour and cost involved in setting it on foot—it is only as leading to a general register of absolute titles that the construction of a general register of possessory titles can take rank as a work of national importance and concern. It is absolute title alone that will enable an ordinary landowner to deal with his land with the freedom and facility and entire absence of cost and delay that attends dealings with goods and with stock. It is absolute title alone that will be accepted by a purchaser or mortgagee on his own responsibility, without recourse to expert assistance.

Now it is obvious that if the clearance of possessory titles be left to the mere operation of time, a great many years will elapse, even in the first county in which a register is compiled, before the general body of landowners will feel the full beneficial results of the establishment of the register, while in the meantime there is some danger that the drawbacks inseparable from a state of transition, if too much prolonged, will cause a certain amount of impatience to be felt, which would make it difficult to extend the system with the desirable rapidity to other counties, and might even imperil the continuance of the work in the original county itself.

For these reasons, among others, it appears to be of the first importance to consider whether the registration of absolute titles cannot by any means be facilitated, either immediately or by some process of confirming possessory titles after the lapse of a short and definite period of probation, so as, if possible, to provide, without undue delay, a large and conspicuous example of the working of the new system in its complete form, which, so long as the great majority of registered titles remain "possessory," cannot be said to exist.

In the first place, there can be little doubt that the simplest, and in the end by far the cheapest, way to effect the desired result would be to proceed systematically through the whole country, parish by parish, registering absolute titles to all properties lying within successively defined areas. In the case of settled or incumbered estates there should be power to raise the costs by means of terminable annuities, like improvement charges, having priority over all subsisting estates and interests in the land. By taking all properties together, inquiries could be shortened and facilitated—everyone being interested in giving correct information. Owing to the quasi-publicity of the proceedings, the chances of fraud or mistake would be reduced to a minimum. The result, when attained, would be definite, lasting, and uniform. This is the method which has been successfully adopted in other European countries where registers of this kind have been established.

If this plan should appear too "paternal" to be suitable to this country, it would be worth consideration whether it might not be possible to construct immediately a general register of absolute titles, on sale and other occasions, in a similar manner to the present system under which possessory titles are being registered, premising, of course, a considerable modification, in favour of the applicant, of the present practice in regard to applications of this nature. That this could be done without imposing too great a burden on ordinary purchasers seems fairly clear, for the reason that, if only it were settled that every property coming on to the register was to be subject to the same rule, the general standard of correctness in conveyancing could be very largely relied on. This, and the accumulated general information about titles already

possessed by the Land Registry, would render it possible to eliminate the elements of fraud and mistake by means of precautions only slightly, if at all, in excess of those now required on the registration of a mere possessory title. The official fees for first registration need hardly be raised. A charge—by way of an insurance premium—to be paid to the *next* registered purchaser would suffice as further security for the State against possible claims for compensation under section 7 of the Act of 1897.

Both the above plans would require legislation, and would therefore probably need some time before they could be put into execution. The following suggestion would only need a modification of the rules, and therefore has the advantage of being immediately practicable:—

In the absence of legislative provision, we are thrown back on the initiative of the individual landowners to make applications for absolute titles—an initiative which, up to the present, they have not exhibited to any appreciable degree. The paucity up to the present of applications for absolute title may be attributed to three main causes: (1) Landowners do not as a rule know that such applications can be made at all; (2) those of them who do know have an impression that the cost is usually very heavy; and that (3) though the title is practically perfectly safe, yet some terhnical objection to it may be discovered, and the application consequently be refused. I venture to make the following suggestions as to the removal of each of these impediments:—

The first thing to be done is to place before the landowners themselves information as to the object and purpose of the Acts, and especially as to registration, with absolute title, how it can be obtained, the probable cost, and such other particulars as may be deemed advisable. The registers themselves furnish the names and addresses of the landowners, so that there need be no difficulty, as a rule, in placing the information before those for whom it is intended.

Where land has been registered with a possessory title for a certain time—a few years—an absolute title may safely be granted on much easier terms as to expense than are required where the application is made without such previous registration. The present rules do not countenance any such distinction being made.

It must be remembered that practically all possessory titles are now preceded by a purchase, and an examination of title on behalf of the purchaser.

The result of inquiries made for many years among persons of experience has been to show that where a purchase has been *bona fide* completed in the usual way, and the purchaser has entered into possession or receipt of the rents, and has remained there undisturbed for a year or more, the occurrence of actual loss or trouble of any kind arising out of the anterior title is practically a thing unknown and unheard of; or, to put it another way,

it is a risk so remote that an almost infinitesimal percentage on the value of the property would suffice to ensure against it. The principal mistakes and frauds that occur are in regard to mortgages, owing to their secrecy. The publicity of a sale, followed by alteration of possession, constitutes too great a risk for the intending defrauder. It may also be pointed out that the commonest form of fraud, by duplication of a recent deed, is a risk against which an examination of the anterior title, however strict, affords hardly any protection whatever.

Having regard, therefore, to the great public importance of doing something to accelerate the general registration of absolute titles, it is suggested that in all cases where the following conditions are complied with an absolute title might be granted without putting the applicant to any serious expense:—1. Sale, under ordinary conditions, completed by entry into possession. 2. Possessory title registered for upwards of two years. 3. Applicant's production, and deposit in the registry for a substantial period, of such documents of title as he ought to possess. 4. Public advertisement. Power would, of course, remain, where the value was very high, or where special circumstances suggested the need of caution, to make further inquiry.

The fees for this mode of investigation should be considerably less than the fees now charged for absolute title, and should include every incidental expense. If a solicitor be employed, the scale of remuneration given in the present rules should be modified or abolished, the charges being made according to the amount of work required to be done. In order further to lighten the burden on the first applicant, the next purchaser (who would get the full benefit of the registration) might be required to pay a somewhat higher fee than would be exacted for like dealings afterwards—this payment would in effect be for the insurance fund.

With regard to the supposed disposition of the Land Registry to discover technical flaws in good holding titles, and so to render applications abortive, it will at once be seen that the regulations suggested above would in any case leave very little room for that kind of activity. Further, it may be stated with some confidence that no such disposition exists. There does not appear to be a single case of a title which had been the subject of a *bonâ fide* sale within recent times having been refused registration as absolute. A certain number of applications have been refused, but they have usually been cases in which the owners were aware that they would have trouble if they attempted to sell in the ordinary way, and hoped that the Land Registry might be able in some manner to cure the mischief. This, it need hardly be said, is not the purpose for which the Land Registry is intended. It is not a hospital for weak titles. It is rather an Assay Office, where an ordinary title may be, as it were, hall-marked by public authority, so as to prevent the necessity for repeated private tests on successive future dealings. The standard adopted so far has been

neither above nor below that which is found to be sufficient for practical safety on ordinary sales and mortgages of the various classes of property coming under review.

A regulation that all fees paid should be returned in the event of the title being refused would be advisable. It would remove some hesitation now felt by landowners in applying for absolute titles, and under ordinary circumstances would seldom be called into operation.

JAMES ROBERT HART, F.I.A.

Bristol Insurance Institute,
February 28, 1902.

THE NEW MORTALITY TABLES OF THE INSTITUTE OF ACTUARIES AND FACULTY OF ACTUARIES, KNOWN AS THE BRITISH OFFICES LIFE TABLES, 1893.

THE object of the following paper is to afford to non-actuarial students, and to members of the Insurance Profession who, although not students, are interested in Life Insurance Tables, an opportunity of appreciating the great work in which a Joint Committee of the Institute of Actuaries and the Faculty of Actuaries have recently been engaged, and which, even at the present time (February, 1902) is not yet completed. It may fairly be claimed for this experience, to which sixty Offices contributed, not only that is the largest, but that it is the most complete, and that the care and ingenuity exercised in ensuring both clear tabulation and accurate results have never been surpassed.

There have been six historic collective compilations of the experience of assured lives, which I have, for purposes of record and comparison, tabulated below.

Table I.

Summary of Collective Tables.

	Date when Published.	Name of Experience.	Nationality.	Total Number of Observations.	No. observed in the Principal Table of Mortality.				Percentages.			Years of Life Observed.	Average Durn. of Pols.	Remarks.
					Ents.	Exstg.	Discd.	Died	Extg.	Discd.	Died.			
1	1843	17 Offices - -	British	83,905	62,537	No	infor	mation	..	..	..	546,645	8·7	Males and Females.
2	1869	Institute of Actuaries (20 Offices)-	British.	160,426	130,243	74,698	35,024	20,521	57·3	26·9	15·8	1,200,401	9·22	Hm Table.
3	1881	30 American Offices	American, U.S.A.	1,027,529	982,734	527,157	441,092	44,485	53·7	41·8	4·5	4,327,066	4·40	Males, mostly.
4	1883	German (23 Offices)	German.	566,932	341,744	210,280	94,520	36,944	61·5	27·7	10·8	2,226,728	6·51	Males.
5	1895	French (4 Offices) -	French.	229,143	229,143	120,996	85,530	22,617	52·8	37·3	9·9	1,790,657	7·81	Males and Females.
6	1900	British Offices (60)	British.	1,037,233	608,645	283,999	167,311	157 335	46·7	27·5	25·8	7,659,454	12·58	Om Table.

In addition to these collective experiences, several individual offices have also tabulated their experiences, of which the most important have been the Gotha (published in 1881, comprising 76,986 lives with an average Policy duration of 12·39 years), the Equitable, and the Mutual of New York. The experiences showing the largest percentages of Assurances terminated by death, and the longest average duration of Policies are the most valuable; and in this respect the Whole Life Experience, which will be known as the O^m, stands the highest. It differs in many important respects from every previous experience, and will, undoubtedly, be the Standard Table for this generation of Actuaries.

The new observations include only lives resident in the United Kingdom at the date of entry, not exposed to any special risk demanding an extra, and who had undergone a medical examination, and been accepted without extra premium for impairment. The total number of Policies which were utilised in the experience was 1, 037,233, which were divided into classes, and a summary of the numbers in each class is appended.

[TABLE.

TABLE II.

No. of Policies dealt with in the Tables.

CLASS.	MALE LIVES.		FEMALE LIVES.	
	With Profits.	Without Profits.	With Profits.	Without Profits.
Whole Life Assurances:				
Old Assurances, -	187,462	16,989	16,158	3,433
New " -	485,431	45,197	30,094	8,726
Total, -	672,893	62,186	46,252	12,159
Full Aggregate Tables: Total (old and new), -	551,838	56,807	42,293	11,050
Limited Premiums, -	35,020	1,819	664	97
Ascending " -	18,673	4,607	653	388
Endowment Assces.:				
Old Assurances, -	2,891	2,463	206	189
New " -	113,713	21,347	4,871	1,297
Total, -	116,604	23,810	5,077	1,486
Full Aggregate Tables: Total (old and new) -	109,135	22,908	5,077	1,486
Joint Life Assurances, -	7,098	2,097	5,711	1,511
Contgt. Surv. Assces., -		3,482		1,436
Temporary Assurances,		11,603		1,907
Totals, -	850, 288	109,604	58,357	18,984
	959,892		77,341	
Grand Total, - -	1,037,233			

The observations were tabulated upon cards, a separate card being written for each Policy effected, commencing with the year 1863, and were divided into two portions:—(1) Policies effected with participation in profits, and (2) those effected without participation in profits. Each of these was again sub-divided into (*a*) Old Assurances, effected prior to 1st January, 1863, and

brought under observation at their policy anniversaries in that year, and (*b*) New Assurances effected between 1st January, 1863, and 31st December, 1892. Healthy lives only were observed for the main tables; and the experience of Endowment Assurances, Whole Life Assurances by limited payments and ascending premiums, Joint Life Assurances, Contingent Survivorship Assurances, Temporary Assurances, and Assurances on female lives were all separately examined and tabulated.

At present we are concerned with the principal tables, consisting wholly of healthy male lives. Classes (*a*) and (*b*) in this experience were tabulated together, forming combined tables, consisting of Old Assurances and New Assurances taken together without reference to the dates of the Policies.

I need not detain you to explain at length the reasons for these important separations. It has long been held that each class of Policies would, if sufficient data were available to enable the experience of the different classes to be separately tabulated, shew distinctive rates of mortality; and, so far as Whole Life Assurances are concerned, the new tables will enable us to make proper comparisons.

In respect of Endowment Assurances, however, it is only of recent years that this class has been of sufficient importance to deserve special attention, so that the observations are of recent date, and the bulk of the Policies have only been a few years in force, very few of them as yet having reached maturity, while with the exception of female lives, the other special classes are all small, and the numbers will probably be found to be insufficient to allow of adjustment, and of monetary tables being formed therefrom.

The division into Old and New Assurances will enable a comparison to be made between the mortality of lives belonging to the same class, but with distinctive features. In the first class every Policy existing at the close of the observations had been at least thirty years in force, and the experience may be regarded as almost "complete;" while in the latter, the vast preponderance of the experience is during the first few years after entry. We compare the rates of mortality where the ages are the same, and also the duration of the Assurances; but there is in the New Assurances an increased stringency of medical examination, for all the lives in the first class were assured prior to 1863, while

the bulk of the latter will have been examined during the last fifteen years.

The Tabulation is in Select Tables, all the cards having the same age at entry having been brought together and traced until the close of the observations. The nearest integral age at the date of Assurance was assumed to be on the average the exact age at entry, and the Assurance year—that is, the year commencing on the date or on the anniversary of the date of Assurance—was adopted as the year of exposure to observation.

The following are the observations during the first five years after entry, and of the last seven years of the Whole Life Experience (males), with participation in profits, age at date of Assurance, thirty, and are extracted without alteration from pages 114-117 of the unadjusted data. They enable you to see the form in which the data were published, and to appreciate the clear manner in which the results are presented.

[TABLE.

Table III.

Select Tables.

Whole Life Assurance Experience, 1863-1893, with Participation in Profits. Age at date of Assurance, 30.

Males.

Years Elapsed since Date of Assurance. (1.)	"Old" Assurances, 8,859.				"New" Assurances, 23,361.			Years Elapsed since Date of Assurance. (1.)	"Old" Assurances.			"New" Assurances.			Combined "Old" and "New" Assurances.			
	Entd. (2.)	Exstg (3.)	Wltdls. (4.)	Died. (5.)	Exstg. (6.)	Wltdls. (7.)	Died. (8.)		Expsd. to Risk. (2.)	Died. (3.)	Rate of Mrtlty. (4.)	Expsd. to Risk. (5.)	Died. (6.)	Rate of Mrtlty. (7.)	Expsd. to Risk. (8.)	Died. (9.)	Rate of Mrtlty. (10.)	Curtate Expectation. (11.)
0	.	.	.	.	653	248	72	0	.	.	.	23,113	72	·00312	23,113	72	·00312	35·11
1	607	.	17	3	625	1,577	90	1	590	3	·00508	20,811	90	·00432	21,401	93	·00435	34·22
2	498	.	52	3	553	1,068	108	2	1,053	3	·00285	19,028	108	·00568	20,081	111	·00553	33·37
3	543	.	43	7	537	726	98	3	1,550	7	·00452	17,641	98	·00556	19,191	105	·00547	32·56
4	512	.	35	22	.	530	99	4	2,020	22	·01089	16,476	99	·00601	18,496	121	·00654	31·74
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
60	1	2	.	3	.	.	.	60	21	3	·14286	.	.	.	21	3	·14286	2·40
61	.	1	.	5	.	.	.	61	17	5	·29412	.	.	.	17	5	·29412	1·80
62	.	1	.	3	.	.	.	62	11	3	·27273	.	.	.	11	3	·27273	1.55
63	.	.	.	3	.	.	.	63	8	3	·37500	.	.	.	8	3	·37500	1·12
64	.	.	.	3	.	.	.	64	5	3	·60000	.	.	.	5	3	·60000	·80
65	.	.	.	.	.	.	.	65	2	.	.	.	.	.	2	.	.	1·00
66	.	1	.	1	.	.	.	66	1	1	1·00000	.	.	.	1	1	1·00000	.
	8,859	2,926	1,450	4,483	14,264	6,882	2,215		173,906	4,483		258,761	2,215		432,667	6,698		

Taking the above figures, we see that 8,859 Old Assurances and 23,361 New Assurances, making together 32,220, were observed. As the observations of the Old Assurances did not commence until the first Policy anniversary in 1863, there can obviously be no Assurances opposite years elapsed since date of Assurance "0." The whole 8,859 Assurances were distributed over the succeeding 66 years, and at the close of the observations it was found that:—

There were still in existence in 1893,	2,926 of various durations.
There had withdrawn . .	1,450 at various times.
And there had died . . .	4,483 at various ages.
Total, . . .	8,859

The duration of each existing Policy, of each withdrawal, and of each Assurance which terminated by death, is given in columns 3, 4, and 5. Similarly, the 23,361 New Assurances were separated nto batches, when it was found that :—

There were still in existence .	14,264 of various durations.
There had withdrawn . .	6,882 at various times.
And there had died . . .	2,215 at various ages.
Total, . . .	23,361

From the above figures at each age, i.e., for each full year of Assurance, there were computed the numbers exposed to risk; the deaths which occurred during the year were already tabulated, and hence the rate of mortality $\frac{\text{Died}}{\text{exposed to risk}}$ for each year of exposure was computed, the results being columns 4, 7, and 10. The last column (11) gives the curtate expectation of life, *i.e.*, the average number of complete years which would be enjoyed by persons living in a community whose circumstances and experience are the same as in this table.

Before passing to the Aggregate Tables, a little further profitable consideration may be given to the fact that these are Select Tables, and to the effect of Selection. Dr. Sprague (report to the Treasury, Govt. Anny. Tables, 1883) has tersely put the matter thus:—

"The medical examinations and the other precautions taken "have the result of eliminating from the general body of persons "whose lives are proposed for insurance almost all those individuals "who are suffering from a disease likely to cause early death, as

"well as persons whose habits are so intemperate that they are "likely to die prematurely; and the effect of this is, that the rate "of mortality among recently insured lives is greatly below the "normal mortality corresponding to their ages. The difference is "greatest in the year immediately following the date of Insurance "and becomes gradually less in each succeeding year, until after "the lapse of an interval which is variously estimated, it disappears "and the normal rate is attained." All the previous experiences in Table I. were compiled in calendar years (or a modification of the calendar year method); for example, in the H^m Table the first year of exposure, year 0, comprised those lives who had entered in any year, observed from the date of their entry up to 31st December of that year. On the assumption that entrants are uniformly distributed over the year, it is obvious that on the average the entrants were only under observation for half-a-year in their year of entry, the time during which they had been under observation ranging from one year (for entrants on 1st January) to one day (for entrants on 31st December). Similarly, the observations in "year 1" comprised all lives who had been insured for periods varying from one year to one day, and on the average they commenced this year after being insured half-a-year. Year 2 was commenced with lives who had been insured on the average for one-and-a-half years, and so on.

For Aggregate Tables, where the lives are brought under observation, regard being had only to their age, and without reference to the time they have been insured, this arrangement of the data, according to calendar years of exposure, is of no moment, but when it becomes of first importance to the Actuary to know, not only what age a life is, but how long a time has elapsed since it was assured, it is necessary to either re-arrange the figures, as was done by Dr. Sprague in his well-known monograph upon Select Tables, or to see that the method of recording and classifying the data will give the rates of mortality accurately during the first year of assurance, during the second year of assurance, and so on. This has been done in the present compilation, and the method is called the policy year method, because the lives are observed through policy years, and not through calendar years. Every life, at the commencement of a policy year of observation, has been the same number of policy years in force, and the exact effect of the duration of an Assurance upon the rate of mortality can be traced.

The following table brings this influence of selection upon the rate of mortality out very clearly. In the second column is tabulated at selected quinquennial ages the rate of mortality (With Participation in Profits: Old and New Assurances) unadjusted, computed from assurances of all durations: the succeeding columns shew the rates during the first, second, third, fourth, and fifth years of assurance, and the last column the rate after five years have elapsed; from this table, called the $O^{m\,(5)}$ Table, all assurances of less than five years have been eliminated, and it is assumed in this presentation of the results that, upon the average, the effect of selection after five years is of so little moment that it may be ignored.

TABLE IV.

WHOLE LIFE ASSURANCE EXPERIENCE 1863–1893. W.P.

Ages Attained.	Probability of Dying, arranged according to years elapsed since date of Assurance.							Ages Attained.
	All Durat'ons Aggreg'te Table.	0	1	2	3	4	5 and over.	
25–29	·00510	·00280	·00420	·00511	·00536	·00575	·00686	25–29
35–39	·00810	·00361	·00581	·00642	·00706	·00734	·00891	35–39
45–49	·01271	·00575	·00891	·00965	·01017	·00997	·01321	45–49
55–59	·02339	·01196	·01682	·01848	·01818	·01874	·02378	55–59

The figures, though in quinquennial groups, are not adjusted, so that irregularities occasionally occur—it is easily seen, however, how low the rate of mortality is in year 0, and how rapidly it increases in years 1, 2, 3, and 4.

The data, however, are so tabulated that investigation can easily be made as to the extent of selection at any age, for the rate of mortality is given at each age, 20 to 79, for each year of assurance up to nine years, and corresponding tables are printed, giving the experience, excluding successively, as well as the first five years of assurance, the first 6, 7, 8, 9, and 10 years. These are called Truncated Aggregate Tables. Separate tables are given for assurances with and without participation in profits, so the

materials at the disposal of an investigator could not well be more complete.

I make no apology to my readers for spending this time upon the effects of selection and the question of policy versus calendar years. The former are frequently referred to in the life assurance literature of the present day, and it is worth spending some time and trouble to master them.

The Aggregate Tables now claim attention, in which the data are grouped together for each year of age during which the lives were under observation, irrespective of the duration of assurance. Duplicate periods of risk were eliminated. If a man took out one policy at age 30, another at 35, and another at 40, he would appear thrice in the Select Tables, but in he Aggregate Tables only once. Hence the totals of these two classifications are not identical.

In the Select Tables all the entrants at any age are separated and traced through each year of their existence to find the rate of mortality in that year, until the last dies. Thus in the Aggregate Tables at age 34, 18,525 lives entered upon this age made up of lives who entered at 20 (or even earlier) who had been insured 14 years, of lives of 21 who had been insured 13 years, and so on, down to the lives insured at 33, one complete year in force, and those of 34, just entering.

A little consideration will enable you to perceive that the comparative number of recent entrants has a grave disturbing effect upon the rate of mortality in the Aggregate Tables, because of the light mortality, already shewn to exist, among recently selected lives. In fact we might have two tables, A and B: let A consist mainly of recently selected lives, and in B let the lives have been insured for, on the average, a considerable time: the lives in A might be subject to a heavier mortality than the lives in B when analysed in Select Tables, but owing to recent medical examination, the rates of mortality in the Aggregate Tables of A (when so many more of the lives would be subject to a lighter rate of mortality than in B) would be much less than those of B.

For these reasons a comparison of the rates of mortality of Aggregate Tables is apt to be misleading, though attention to the average duration of the Policies will be a guide to enable one to appraise the results correctly.

The following table shews, from a comparison of columns 1 and 3 with columns 2 and 4 that the new assurances have experienced

lighter rates of mortality than the old; but to shew how much of this was due to improved medical examination and diagnosis, and how much to the influence of a large body of recently selected lives, would require a long and detailed analysis.

TABLE V.

BRITISH OFFICES TABLES.

One-fifth of the sum of q_x (ungraduated rates of mortality) in selected quinquennial groups for the undernoted experiences.

Ages.	With Profits.		Without Profits.		Combined Old and New Assurances.	
	Old Assurances. (1)	New Assurances. (2)	Old Assurances.	New Assurances. (4)	With Profits. (5)	Without Profits. (6)
25–29	·0080	·0049	·0088	·0059	·0051	·0062
35–39	·0100	·0077	·0104	·0087	·0081	·0090
45–49	·0143	·0118	·0150	·0135	·0127	·0140
55–59	·0239	·0228	·0263	·0230	·0235	·0246
65–69	·0498	·0478	·0531	·0482	·0493	·0513

The figures at intermediate ages shew the same features, but I do not wish to burden you with a mass of figures, so I omit them.

Comparing columns 5 and 6, the rates of mortality in 5 (with profits) are throughout lighter than those of 6 (without profits). The question immediately arises as to how much of these results arises from a large number of recently selected lives (an apparent light mortality only) and how much from a real difference in the mortality rates. I think we can answer this if we examine the Select Tables and compare the respective rates at the same ages, and also at the same Policy durations. Take ages 30–34 and 40–44 as examples (pp. 478 and 479 of the Tables):—

UNADJUSTED RATES OF MORTALITY FOR THE UNDERNOTED QUINQUENNIAL GROUPS OF AGES.

Year of Assurance.	30–34.		40–44.	
	W.P.	N.P.	W.P.	N.P.
0	·00355	·00371	·00516	·00684
1	·00478	·00748	·00666	·00982
2	·00568	·00518	·00785	·01019
3	·00590	·00856	·00849	·01229
4	·00640	·00678	·00864	·01445
5	·00645	·00787	·00883	·01378
6	·00765	·00919	·01004	·01073
7	·00776	·01268	·00986	·01112
8	·00774	·00776	·01053	·01209
9	·00821	·01035	·01006	·01135
10 and over.	·00801	·00641	·01111	·01228

In the above examples both groups of lives are so nearly of the same average age that our conclusion is inevitable, viz., that at these ages the rate of mortality among lives insured without profits is appreciably greater than among lives insured with profits, and similar results are obtained by comparing similar figures at other groups of ages.

It is however not always possible to make such a comparison as the above, and in that case a very fair indication of the relative features of different tables can be obtained by comparing the rates obtained (1) from Aggregate Tables, (2) by excluding the first five years of assurance, and (3) by excluding the first ten years, and the table which follows comprises the figures for most of the experiences in Table I. in selected quinquennial groups.

TABLE VI.

RATES OF MORTALITY IN SELECTED QUINQUENNIAL GROUPS OF AGES ACCORDING TO VARIOUS EXPERIENCES.

Ages.	H^m	Am	$Germ^n$	Fr	O^m	N^m
25-29	·0069	·0068	·0071	·0061	·0051	·0062
35-39	·0095	·0079	·0101	·0090	·0081	·0091
45-49	·0136	·0108	·0159	·0139	·0127	·0140
55-59	·0240	·0186	·0296	·0260	·0234	·0246
65-69	·0502	·0382	·0579	·0536	·0490	·0508

Ages.	H^{m5}	Am^5	G^{m5}	O^{m5}	N^{m5}
25-29	·0097	·0090	·0087	·0069	·0084
35-39	·0108	·0088	·0112	·0089	·0097
45-49	·0143	·0110	·0168	·0132	·0144
55-59	·0250	·0188	·0305	·0238	·0254
65-69	·0515	·0393	·0582	·0492	·0518

Ages.	H^{m10}	Am^{10}	G^{m10}	O^{m10}	N^{m10}
35-39	·0116	·0091	·0107	·0091	·0105
45-49	·0151	·0117	·0168	·0130	·0142
55-59	·0254	·0173	·0306	·0239	·0254
65-69	·0514	·0399	·0582	·0490	·0525

I do not think I need go into detail with these figures. I need only call attention to the general result, which is, that the O^m Tables show lighter rates of mortality than any others (except the American), and that the American observations were peculiar —being mostly under fifteen years' duration—and treated in a manner different to any of the other Tables.

I now turn to the Endowment Assurance Experience. No previous investigation of mortality among this class has been made, and the results are therefore of great interest. The Select

Tables comprise 947,753 years of risk, and the Aggregate Tables 897,673 years, as undernoted:—

ENDOWMENT ASSURANCE EXPERIENCE, 1863–1893.—MALES.

	Entered.	Existing.	With-drawals.	Termina-tions.	Died.	Years of Risk.
Select Tables,	140,414	97,314	30,898	6,181	6,021	947,753
Aggregate Tables,	132,043	90,447	29,949	5,918	5,729	897,673

The With and Without Profit Assurances were combined, but males and females were separated. I must dismiss the female experience with the statement that the entrants were 6,563 in number, and that 42,646 years of life were observed.

The great bulk of this experience consists of recently-selected lives, which is no doubt one of the reasons why the Aggregate Tables show a very low rate of mortality; but as the experience was detailed in Select Tables on exactly the same lines as the Whole Life experience, a comparison of the respective rates of mortality is not difficult, although the data, when separated into Select Tables, are not sufficient to prevent the resulting rates being very irregular. A similar table to Table III. is appended, and it will be at once observed how much lighter the rates of mortality are than under the Whole Life Tables. Those who formerly held, and freely expressed, opinions that the Endowment Assurance class should be recognised as an entity with distinctive rates of mortality and other features have now these Tables to which to appeal in support of their contentions. Very shortly we shall, no doubt, have presented to us premiums based on these results, and they will certainly be low. The effect of medical selection seems to be less than in the Whole Life class, and I attribute the low rate of the Truncated E^{m5} Table to the selection exercised by the Assured when they chose this system. All were no doubt convinced that they were good lives and would attain their endowment ages, whereas those who suspected or feared some hereditary or personal weakness would go into the Whole Life class, thus bringing up the rate of mortality of that class when their forebodings were in some instances fulfilled. The selection in favour of this class, however, was probably stronger when it

first came prominently before the public (long accustomed to insure under the Whole Life Table only) than it is now when it is being so much pushed as a profitable investment, and when, to all appearances, about as many lives enter it as enter the Whole Life classes.

TABLE VII.

ENDOWMENT ASSURANCE EXPERIENCE, 1863–1893.—WITH PROFITS.

Ages Attained.	Probability of Dying arranged according to Years Elapsed since Date of Assurance.							Ages Attained.
	All Durat'ns Aggr'g'te Table.	0	1	2	3	4	5 and over.	
25–29	·00383	·00209	·00299	·00387	·00485	·00452	·00531	25–29
35–39	·00548	·00298	·00440	·00473	·00423	·00547	·00623	35–39
45–49	·00992	·00570	·00335	·00800	·00846	·00578	·01054	45–49
55–59	·02111	·01136	·02020	·01422	·02128	·02574	·02041	55–59

Passing to the other classes of Assurance, the experience of which has been taken out, I do not propose to detain you long over them. They contain material for many an investigation, but in a brief survey of the new tables, such as this can only be, I am compelled to concentrate my attention upon the principal tables, dealing with these minor classes not as they deserve, but as my space permits.

I append the sum of the rates of mortality at the same quinquennial ages and in the same form as those in Table VI. for three of these classes.

TABLE VIII.

ONE-FIFTH OF THE SUM OF q_x (UNGRADUATED RATES OF MORTALITY) IN SELECTED QUINQUENNIAL GROUPS FOR LIMITED PREMIUMS, ASCENDING PREMIUMS, JOINT LIVES, AND ENDOWMENT ASSURANCES (ALL MALES).

Ages.	With Profits. O^m. (1)	W.P. Endowment Assurances. (2)	W. & N. P. Limited Premiums. (3)	W. & N. P. Joint Lives. (4)	W. & N. P. Ascending Premiums. (5)
25–29	·0051	·0038	·0044	·0047	·0058
35–39	·0081	·0054	·0063	·0092	·0083
45–49	·0127	·0100	·0091	·0143	·0128
55–59	·0235	·0212	·0200	·0236	·0225
65–69	·0493	...	·0443	·0569	·0538

As compared with the rates for the Whole Life experience, it will strike you at once that the rates under Limited Premium Policies are very low, while the others approximate more closely to the Whole Life rates. At young ages the Ascending Scale rates are generally above, and the Joint Life rates below, the Whole Life rates.

Although the experience in columns 3, 4, and 5 included With Profit as well as Without Profit Policies, still, the preponderance of the With Profit class was so marked (*see* Table II.) that it may fairly be compared with the O^m Table only. In these classes the New Assurances were not separated from the Old, and the female lives (except for the Joint Life experience) not dealt with.

My last examination is of the Female experience, with profits, in which the number of entrants reached 46,252. The 12,159 lives observed in the Without Profits class have not been combined with the larger group. The number of years of life observed was 553,886 in the Select Tables and 507,042 in the Aggregate Tables. This is a much greater number than those of previous British experiences, the numbers of the other principal observations being—

	No. of Years of Risk.
In the H^m, . . .	161,417
„ German, . .	683,952
„ French, . .	381,914

from which it will be seen that the German experience has up to the present been the most extensive.

A comparison of the rates of mortality at selected quinquennial ages gives most instructive results, but I will only refer to one, —viz., the great diminution in the rates of mortality in the O^m and O^{m5} Tables as compared with the H^m and H^{m5} Tables. I should not attribute this improvement to any one cause, but to several, among which may be mentioned improved medical diagnosis, greater success in dealing with the diseases of women owing to antiseptic surgery, and the generally healthy lives which the women of the middle and upper classes now lead, these classes forming the greater part of the experience.

TABLE IX.

COMPARISON OF RATES OF MORTALITY AT SELECTED QUINQUENNIAL AGES FOR FEMALE LIVES.

	17 Offices	H^F	G^F	Fr^F	O^F	H^{F5}	O^{F5}
25–29	·0135	·0118	·0111	·0070	·0082	·0122	·0073
35–39	·0159	·0121	·0125	·0083	·0102	·0138	·0114
45–49	·0169	·0139	·0135	·0110	·0122	·0157	·0130
55–59	·0261	·0202	·0233	·0165	·0199	·0230	·0204
65–69	·0482	·0437	·0514	·0410	·0429	·0462	·0434

The only classes which I have not mentioned are the contingent survivorship assurances, the temporary assurances, and the joint life female experience. In each of these the data are very small, and, though valuable, their consideration may well be omitted here.

I am conscious that in this brief survey I have not nearly covered all the ground, but the subject is a very large one, and my difficulty in writing this paper has been to decide what to omit and not what to include. For example, I have not considered that it fell within the scope of this paper to include an examination of the Annuity experience, interesting though this would, no doubt, prove itself to be.

Turning from the consideration of the pure mortality Tables to the application of them, this subject would alone afford material for a paper in itself, but there are two questions in particular which are of supreme importance—

1. The effect of the new tables upon Reserves,
2. " " " " Office Premiums,

and I shall conclude this paper with a short reference to each of these.

1. As to the effect upon Reserves and in Valuations. The principal point to bear in mind when discussing this question is that it does not depend upon whether the table we are comparing with another table shows a lighter or a heavier mortality—it depends upon the incidence of the mortality at different ages in a particular manner, as hereinafter explained. A new table, such as the present O^m Table, may shew a lighter mortality throughout than the H^m Table, with which we may wish to compare it, but you cannot make the deduction from that fact alone either that the Reserves by this table are greater than, or are less than, the H^m Table. If the rates of mortality by the O^m Table are light at young ages and become gradually heavier at older ages (as compared with any other table selected as a standard), it will be a table giving larger Reserves on the average than the standard selected; if the rates of mortality are higher at young ages and lower at older ages than the selected table, it will give smaller Reserves. If it has no persistent feature of this kind, it may produce higher Reserves at one age and duration, and lower at other ages and durations. The formula for the value of a policy is $1 - \frac{1 + a_{x+n}}{1 + a_x}$ or $1 - \frac{a_{x+n}}{a_x}$ where $1 + a = a$, and the significance of the symbols may be stated in words as follows:—

The Reserve Value of a Policy at any given rate of interest depends upon the ratio between the annuity-due (or annuity the first payment of which is made immediately, and future payments at intervals of one year if the life be then alive) at the present age of the life, and the annuity-due at the age of entry. A short comparison of Annuity and Assurance Values is appended at 3 per cent. interest.

[TABLE.

TABLE X.

Values of Annuities at 3 °/₀ (1 per annum).			Values of Assurances at 3 °/₀ (1 at death).	
Age. x	H^m a_x	O^m a_x	H^m A_x	O^m A_x
20	22·04	22·71	·329	·310
30	19·87	20·26	·392	·381
40	17·18	17·39	·471	·464
50	13·90	14·05	·566	·561
60	10·24	10·38	·673	·668
70	6·66	6·81	·777	·773

The appended TABLE XIA. shews :—

(1) The ratio of a_x by the H^m Table to a'_x by the O^m Table.

(2) " a_x " H^{m5} " a'_x " " "

(3) " a_x " H^{m5} " a'_x " O^{m5} "

from which by inspection we can tell whether a policy of a given duration, taking any of the tables as a standard, is of greater or less value than that shewn by any of the other tables which are shewn. Specific values are also shown in Table XI., a comparison of which will enable you to form some idea of the consequences of a change from the "Institute" to the "Offices" tables. You must bear in mind when considering the figures, that in any given office the number of policies during the first few years after issue is very large compared with the number of old policies, and that the greatest number of entrants occurs around age 30, rising rapidly from 20 to 30, and diminishing gradually thereafter.

TABLE XI. VALUE OF POLICIES AT 3 %.

Age at Entry.	Duration.	H^m	O^m	H^m and H^{m5}	O^m and O^{m5}
20	5	4·36	4·92	6·83	6·58
	10	9·44	10·30	10·92	11·36
	20	21·12	22·40	22·09	22·84
	30	35·35	36·50	36·10	36·71
	40	51·24	51·98	51·63	52·06
	50	66·77	67·05	66·94	67·06
30	5	6·14	6·49	7·50	7·23
	10	12·90	13·50	13·96	13·98
	20	28·61	29·21	29·44	29·45
	30	46·16	46·47	46·59	46·56
	40	63·31	63·27	63·49	63·28
40	5	8·71	8·77	9·78	9·16
	10	18·05	18·16	19·00	18·44
	20	38·18	38·11	38·68	38·22
	30	57·88	57·54	58·09	57·55
50	5	12·10	12·06	12·92	12·29
	10	24·57	24·38	25·18	24·51
	20	48·60	48·12	48·86	48·13
60	5	16·18	16·10	16·76	16·18
	10	31·86	31·39	32·20	31·41

Table XIa.

Ratios of Annuities-due, Table $\frac{a_x}{a'_x}$ for comparison of Policy Values.

Ages.	$\frac{H^m}{O^m}$ f_x	$\frac{H^{m5}}{O^m}$ h_x	$\frac{H^{m5}}{O^{m5}}$ j_x
25	·9778	·9526	·9695
30	·9813	·9654	·9769
35	·9850	·9707	·9784
40	·9881	·9760	·9816
45	·9888	·9772	·9814
50	·9895	·9780	·9814
55	·9890	·9797	·9823
60	·9870	·9791	·9807
65	·9860	·9793	·9802
70	·9804	·9754	·9754
75	·9739	·9682	·9682

Example:—The value of a Policy effected at age x, present age x + n, by the

H^m Table is > = or < the value by the O^m Table as f_x is > = or < f_{x+n}
H^{m5} ,, ,, ,, O^m ,, h_x ,, h_{x+n}
H^{m5} ,, ,, ,, O^{m5} ,, j_x ,, j_{x+n}
H^{m5} ,, ,, ,, O^m and O^{m5} ,, h_x ,, j_{x+n}
H^m & H^{m5} Tables ,, ,, O^m ,, f_x ,, h_{x+n}
,, ,, ,, ,, O^m and O^{m5} ,, f_x ,, j_{x+n}

Example:—The value of a Policy taken out at age 25 by the H^m and H^{m5} Tables compares as under with the value of the Policy by the O^m Table and with the value by the O^m and O^{m5} Tables.

[Table.

STANDARD OF COMPARISON, H^m AND H^{m5}.

Duration in Years.	The Value by the O^m Table is	The Value by the O^m and O^{m5} Tables is
5	less.	less.
10	"	greater.
15	"	"
20	"	"
25	greater.	"
30	"	"
35	"	"
40	"	"
45	less.	less.
50	"	"

Speaking generally, the following appear to be the main results:—

The values of Policies at any given rate of interest—

(1) By the H^m Table are at the principal insuring ages less than by the O^m Table. Exceptions:—Values of Policies of long duration are generally less, and of Policies effected above age 45 generally greater.

(2) By the H^m Table are generally less than the O^m and O^{m5}, except for long durations.

(3) By the H^m and H^{m5} Tables are generally greater than by the O^m Table. Exceptions:—Policies of young ages at entry and long durations.

(4) By the H^m and H^{m5} Tables are generally greater than by the O^m and O^{m5} Tables. Exceptions:—Young ages at entry.

NOTE.—Since this paper was written Mr. Geo. King has published his interesting figures containing the results of Valuations of his "Model Office" by the new Tables at 3 per cent., showing that in an office more than five years established the Reserves by the O^m Table are greater than the H^m, while a valuation by the

O^m and O^{m5} Tables (O^m first 5 years and O^m and O^{m5} after) was greater than the H^m and less than the H^m and H^{m5}, but only by a very small amount, as the following figures will show :—

BRITISH OFFICES TABLES—COMPARATIVE RESERVES :—

TABLE A. H^m 3°/₀ Reserve taken as 1000.

Age of Office.	H^m 1st 5 years, H^m and H^{m5} after.	H^m.	O^m.	O^{m5} throughout.	O^m 1st 5 years, O^m and O^{m5} after.	O^m and O^{m5} throughout.
5	1000	1000	1031	990	1031	1209
25	1034	1000	1016	994	1029	1042
50	1020	1000	1010	994	1017	1023

TABLE B. Combined H^m and H^{m5} 3 per cent. Reserve taken as 1000.

Age of Office.	H^m 1st 5 years, H^m and H^{m5} after.	H^m.	O^m.	O^{m5} throughout.	O^m 1st 5 years, O^m and O^{m5} after.	O^m and O^{m5} throughout.
5	1000	1000	1031	990	1031	1209
25	1000	967	982	961	995	1007
50	1000	980	990	974	996	1003

To most Offices the last figures will be applicable, viz., those for an Office fifty years established.

These comparisons enable one to make an approximation to the probable effect of a change of Table in the Valuation of an Office much better than any examination of individual policy values. In the case of the New Experience also, the introduction of Bonus Values will still further slightly reduce the Reserves.

I venture to think that these conclusions will be found very interesting. Most offices now value by either the H^m or the H^m and H^{m5} Tables, and the most likely changes in the near future are likely to be:—

1. From the H^m to the O^m and O^{m5}.
2. From the H^m and H^{m5} to the O^m and O^{m5}.
3. From the H^m and H^{m5} to the O^m and O^{m5} at a lower rate of interest.
4. From the H^m to the O^m.
5. From the H^m to the O^m at a lower rate of interest.

Even if it is found that a change to the new tables will require a less reserve it is still possible that one or two changes such as 2. or 4. may take place, because in the first place the difference between the respective valuations will be small, and secondly, the O^m Tables more accurately forecast the probable mortality than the H^m and so eliminate to some extent that factor in the production of surplus which has been frequently alluded to in the reports of many companies in recent years, viz., profit from light mortality, which will, under a valuation of O^m net premiums be thrown into loading.

To enable you to appreciate this change, I beg to submit the following:

TABLE XII.

RATE OF INTEREST, 3 PER CENT. COMPARISON OF LOADINGS. H^m AND O^m TABLES.

Age at Entry. x	Office Pm. to insure £100. π_x (1.)	Net Pms. P_x H^m. (2.)	Loading ϕ_x $(\pi_x - P_x)$ (3.)	Percentage of loading to gross pms $\phi_x \div \pi_x$ (4.)	Net Pms. $O_m P'$ (5.)	Loading ϕ'_x $\pi_x - P'_x$ (6.)	Percentage of loading to gross pms $\phi'_x \div \pi_x$ (7.)
20	1·950	1·427	·523	26·8	1·306	·644	33·0
25	2·175	1·625	·550	25·3	1·524	·651	30·0
30	2·450	1·880	·570	23·3	1·790	·660	26·9
35	2·800	2·193	·607	21·7	2·116	·684	24·4
40	3·225	2·589	·636	19·7	2·524	·701	21·7
45	3·800	3·114	·686	18·1	3·016	·754	19·8
50	4·550	3·801	·749	16·5	3·730	·820	18·0
55	5·525	4·725	·800	14·5	4·641	·884	16·0
60	6·900	5·987	·913	13·2	5·872	1·028	14·9

Column 1 shows assumed office premiums at quinquennial ages at entry, which may be taken as fair average ones. They are taken, for convenience sake, from Mr. G. J. Lidstone's paper on the Distribution of Surplus (J.I.A., xxxii., 73) in order that I may compare a portion of his Table D with the figures of the new Tables. It will be seen that the net premiums of the O^m Table are at every age less—and considerably less—than the H^m premiums; therefore, the loading or addition to provide for expenses, bonuses, &c., is also greater, and this difference is most conveniently estimated by finding what percentage of the gross premiums is reserved for loading in each case. It is seen that while under an H^m (or H^m and H^{m5}) Valuation the loading reserved varies from about 13 per cent. to nearly 27 per cent. under an O^m (or O^m and O^{m5}) Valuation, it will vary from nearly 15 per cent. to 33 per cent. To further illustrate the effects of such a change I have taken 4,782 lives, and have distributed them from ages 18 to 62 in the same proportion as they would have entered an Insurance Company according to the Offices Experience (O^m Table). I have then summed them in quinquennial groups—my central ages being 20, 25, 30, &c.—and multiplied the figures of each group by the gross premiums, the H^m premiums and the O^m premiums respectively. I thus obtained a body of lives with the weight of the loading distributed, not quite as it would be in a valuation, but with sufficient accuracy for my purpose. The gross premium income is £13,760, and the net £10,858 by the H^m, and £10,446 by the O^m, the loading being respectively 21·1 and 24·1 of the gross premiums. It is thus seen that there will be an apparent gain of about 3 per cent. per annum from loading to Offices making a change from one Table to the other. You must beware of the criticism that since an Office, say Office A (valuing by the H^m or H^m and H^{m5} Tables) reserves only 21·1 of the loading, while Office B (valuing by the O^m or O^m and O^{m5} Tables) reserves 24·1 of the loading—therefore, Office A is not so strong as Office B. The contrary, as I have already indicated, will often be the real state of the case, because, assuming that the experience follows the Offices Tables, Office A has an expected mortality profit which it will realise in the future, whereas Office B has none.

My last enquiry is as to the effect of the new Tables upon Office rates of premium. This it is impossible to answer off-hand, for Office premiums depend upon the judgment of the manage-

ment as to probable future expenses and the incidence thereof, and as to the most probable future rate of interest, quite as much as upon the Table of Mortality chosen. It will therefore be obvious that no definite conclusions can be arrived at. As you are no doubt aware, an Aggregate Table is not a suitable one from which to compute Office rates, chiefly because it takes no account of the light mortality arising from medical selection in the early years of Insurance. The Select Tables are now acknowledged to be the best for this purpose; and I am fortunately able to lay before you the results, just obtained by Mr. G. F. Hardy from his graduation of the Select Tables, of the new experience. They show that, as compared with Dr. Sprague's Tables at 3 per cent. interest, they are less by nearly 4s. at age 20, diminishing to 2s. 9d. at age 35, and thereafter increasing at first gradually to 3s. 10d. at age 50, and then more rapidly to 7s. 7d. at 60 and 11s. 7d. at 65.

TABLE XIII.

SELECT NET PREMIUMS AT 3 PER CENT.

COMPARISON OF GRADUATED $O^{[M]}$ ANNUAL PREMIUMS WITH DR. SPRAGUE'S $H^{[M]}$ PREMIUMS.

Age at Entry.	$O^{[M]}$ Select Premium (1.)	$H^{[M]}$ Sprague's Select. (2.)	Excess of 2 over 1.			
					s.	d.
20	1·365	1·563	·198	or	4	0
25	1·551	1·703	·151	,,	3	0
30	1·785	1·925	·140	,,	2	10
35	2·081	2·218	·137	,,	2	9
40	2·457	2·602	·145	,,	2	11
45	2·940	3·106	·166	,,	3	4
50	3·564	3·755	·191	,,	3	10
55	4·377	4·635	·258	,,	5	2
60	5·446	5·827	·381	,,	7	7
65	6·854	7·433	·579	,,	11	7

The publication of these figures will, I think, tend to reduce average office rates for ages above fifty-five, in comparison with those at younger ages. That rates generally will decrease in the

face of our growing expenditure upon commission, and of a gradually falling rate of interest (notwithstanding the check given to this fall by the war in South Africa, which is, however, more than neutralised by the increase in the Income Tax), I do not think probable. I have had occasion in this paper to call your attention to the difference in the mortality of the various classes; I do so again, in order to emphasise the fact that we have been chiefly considering to-night the O^m Table, formed from the participating Whole Life Experience, and that the Reserves, Net Premiums, and Select Premiums, of which examples have been given, have been based upon this table; but the mortality of the New non-participating experience approximates to the H^m much more closely than the O^m does, so much so indeed, that I anticipate that very little difference in rate will will be shewn between the H^m select Premiums and the N.P. British Offices Select Premiums.* Hence it is not probable that those Offices who now charge low non-participating Premiums will reduce them any further. It is not

* Since the above was written Mr. Chatham has kindly placed at my disposal some figures which confirm this anticipation. He has calculated Select Rates at 3½ per cent. from the unadjusted data and finds that "the rates range themselves "very much in the following order: Endowment Assurances, Limited Payment, "Whole Life, Ascending Scale, Temporary Assurance, Contingent Survivorship. "The general principle seems to be, the higher the rate of premium, the lower "the rate of mortality. Another conclusion to be drawn is that the selection "exercised against an office by a proposer in the choice of his class of Assurance "is much greater than has generally been supposed."

The following Table shews the differences between the W.P. and N.P. rates, and compares these with Dr. Sprague's Select Rates.

TABLE C.

Comparison of With and Without Profit Select Rates at 3½ per cent.

Age.	Chatham's Select Rates.			Sprague's Select.		
(1)	W.P. (2)	N.P. (3)	3–2 (4)	(5)	5–2 (6)	5–3 (7)
22	1·350	1·431	·081	1·514	·164	·083
32	1·792	1·888	·096	1·921	·129	·033
42	2·512	2·706	·194	2·662	·150	—·044
52	3·774	3·951	·177	3·934	·160	—·017
62	5·893	6·226	·333	6·255	·362	·029

It will at once be noted how little difference there is in the premiums by the new N.P. Tables, and by Dr. Sprague's Tables, based on the H^m experience. The differences between columns 5 and 2 are less than the corresponding differences in Table XIII. (Adjusted Rates at 3 per cent.).

Female Lives: Mr. Chatham says "an extra of 5s. per cent. per annum up to age 50 is amply justified by the results of the new experience."

His paper (*Transactions of the Faculty of Actuaries*, vol. i., No. 5) is most interesting and will well repay study.

unlikely, however, that Offices now charging rates above the average will, if they consider it advisable to change their scale, adopt the New Tables, lower their rates in respect of their without profit tables, and so bring down the average. Turning to the With Profit Select Rates, it may be argued—here are new net premiums at insuring ages from 2s. 9d. to 3s. less than the premiums upon which most Office W.P. rates are now based—the Offices should, therefore, reduce their With Profit Premiums. The argument is best answered by referring to the Offices who have only just been able in recent years to maintain their Bonus and those who have had to reduce it. Very few Offices have been able to increase their rate of Bonus. A reduction, therefore, in With Profit Premiums would simply mean an inevitable reduction in the rate of Bonus, because the causes which would neutralise the consequent natural fall, viz., an increased rate of interest, or diminished expenditure, are absent. So long, therefore, as our Bonus system maintains its hold upon the Insuring public, I think that no great change in With Profit rates is impending.

Again referring to Mr. Lidstone's average rates, a suitable loading of the new 3°/₀ $O^{[m]}$ net rates produces much the same office rates from ages 20 to 55; above 55 they become less.

TABLE XIV.

Age.	Average Office Premiums.	New W.P. Office Premiums.
	£ s. d.	£ s. d.
20	1 19 0	1 19 1
25	2 3 6	2 3 6
30	2 9 0	2 9 0
35	2 16 0	2 16 0
40	3 4 6	3 4 10
45	3 16 0	3 16 3
50	4 11 0	4 11 0
55	5 10 6	5 10 2
60	6 18 0	6 15 5
65	..	8 8 8

Notice that at the chief insuring ages the rates are the same.

We see then that the new Tables will probably not make any great revolution in rates, just as I have already shewn that they will not materially affect the results of our valuations. The Tables are nevertheless of great value. They confirm the results of previous investigations; they afford information upon many points, previously obscure, and enable us to adjust our premiums, our reserves, and our surrender values, to suit the gradually changing circumstances of a complex civilization; they will, when the complete monetary tables are published, afford a useful and accurate tool for the Actuary, and for all engaged in the business of Life Insurance; they will enable us to adjust our rates as between the different classes of business in order to agree with our experience; they will enable us to adjust our bonuses so as to discriminate with equity between the surplus which should be allotted to Whole Life Policies and those which should be allotted to Endowment Assurances or to other Classes; and finally, they give us all confidence, in that each investigation broadens the basis of our science, and of our business, and renders the latter easier to conduct with safety and profit to our Assured.

PHILIP L. NEWMAN.

Yorkshire Insurance Institute,
February 28, 1902.

HELPS AND HINDRANCES.

"HELPS and hindrances as applicable to the successful conduct of Life Assurance business in Canada" has been suggested to me as an appropriate theme upon which to write a paper for submission to a meeting of our Association.

The Aims and Objects.

The aims and objects of Life Assurance being the betterment of the people generally, through the encouragement of thrift, unselfishness, and loyalty to the loved ones of the home circle, by making adequate provision for future years, suggests that the heads of the institutions, acting as trustees of the savings intended for the realisation of these worthy objects, should be men of integrity, high principle, faithful and zealous. A correct conception of the aims and objects of our business is necessary in order to have those who are its controlling officers helpful in rightly developing and conserving its sacred interests. In Canada we have worthy men in the highest positions of trust, and in saying this I think we are sufficiently broad and sufficiently experienced not to compare ourselves with ourselves—which scriptures of truth tell us is not wise—but knowing something of the able men of other lands, we can, with a degree of pardonable pride, refer to the officials in Life Assurance circles, in our own fair Canada, as capable, honest men, earnest workers and great helpers in the field of their operations.

The Directors.

The work of planning and supervising the affairs of a Company requires faithful counsellors, and the Life Companies are fortunate and are to be congratulated upon having excellent Boards of Directors. I cannot emphasise too strongly the great value such counsellors are to the *man at the helm*. They possess wisdom

which has been gleaned from the various avocations of business life followed by them, and are able to bring to bear a sound judgment and a strong will respecting many of the knotty propositions submitted. In connection with investments especially is their advice sought and respected. There is no more important part of the duties connected with the management of an Office than the proper care of the Funds; but I need not dwell on this phase, as it is so well understood and recognised. In other directions no less are Directors very helpful to the chief executive officer. In their sympathy is strength, and in their countenance encouragement.

Medical Men. Companies depend very largely upon their Local and Chief Medical Examiners for the class of lives upon which policies are issued, and while there has not been any special course of study or instruction given in the various medical colleges respecting Life Assurance, we, in Canada, are fortunate in having educational institutions that furnish information of a broad and useful character; and when diplomas of proficiency are granted, those receiving them may be regarded as well qualified to discharge faithfully and creditably the duties required. As a class the physicians of Canada are a painstaking, conscientious community, and their advice has been sound, as shown in the experienced mortality of all the Life Companies. Where an examiner is found capable of defrauding a Company, his name should be given to our Association and black-listed. This course would prove a severe punishment, and at the same time it would be appreciated by the great majority of the honest physicians who are incapable of wilful wrong-doing, and who are helpers in the great work of beneficence which the Life Companies are carrying on.

Frauds.

Agents. The producers of business, the agents everywhere—and what an army they make!—have often been called missionaries; they truly are such in a marked degree. They labour with men to teach them the value of systematic saving, of the absolute necessity and wisdom of association in order that reasonable provision can be made for their dependent ones in the event of premature death, or a competency for themselves if they should be spared to reach

old age. The agents are integral factors of the Companies, without them Life Assurance would have a very small hold upon the affections of the people; as it is, we can proudly point to the fact that there is close upon 450,000,000 dollars of insurance carried by the Companies on the residents of Canada, and this without taking note of the benefits sought in Friendly and Assessment Societies. The saving for this protection amounts to the sum of 15,000,000 dollars annually and goes on steadily increasing. I quote from an interesting paper recently read by Mr. Wilson-Smith before an Insurance gathering in Montreal. "Life Assurance," he says, "is one of the most effective allies of those forces which are helpful in moral dignity and Christian character. It is the foe of poverty, of wasteful habits, of selfish indulgence, of hard-hearted indifference to the probable fate of a man's family. It is an influence that restrains crime as well as folly, therefore life assurance can justly claim to be one of the bonds of society." If volumes were written in praise of the men who have caused this saving, who have brought about this happy condition of affairs, they would not contain sufficient to fully express the appreciation of the healthy helpfulness the world is deriving from the lives of the honest, self-sacrificing, hard-working agents.

Helping the Agent.

The Companies help or hinder their honourable agents in the field, just in proportion to the relation existing between them, and the ability of the Head Office to sympathise with the difficulties encountered. Some Companies study carefully the situation and deem no labour too great towards providing new and attractive methods or a combination of plans to catch the attention and secure the applications of those who should have the protection of Assurance. The American Companies are particularly enterprising in this respect. The volume of business obtained, the returns given, and the general progress made go far to show the appreciation given thereto by the public. Canadian Companies are also most enterprising, but the British Companies, pointing with pride to the accomplishments of those at home, are slower to move. They do not act upon the assumption that to sell a desirable article it should be necessary to dress it up shop-window, kaleidoscopic style, exposing points or the whole, as may be desired, to the passer-by. They are right in a certain sense, inasmuch as Insurance, in all the multifarious forms in which it is

presented, depends upon two ever-present factors—the duration of life, and the value of money; but this is not patent to many, in fact very few, and consequently, so long as there are varieties of ideas as to the form of protection that is deemed necessary, there should be no hesitation, indeed there should be a desire on the part of the Companies to arrange plans that will suit all reasonable contingencies.

Assistance.

How often in canvassing for actual prospective business have the agents of certain Offices found that a peculiar modification or combination of plans has been under consideration, offered by Company A. to the client, which an agent had regarded as all but secured on the old-fashioned ordinary endowment. He is met with the statement, "I like the *double-acting non-experimental, evolutionised policy* offered by Mr. X.; have you it?" The agent replies, "No; it is not good enough, not in it with the plan I submitted." The canvassed is very apt to remark "Sour grapes," and end the interview; whereas, if the agent could have said "Certainly, here it is, and at the same price," the chances are the client would not want it, would not take it at any price, but would be easily convinced of the desirability of the former plan.

Agents' Associations.

Agents should form associations, inform themselves thoroughly respecting Insurance principles and practices, and drum out of their ranks men who are unworthy of confidence, for I believe there are some now existing; men who promise investors amounts in return totally disproportionate to the amount to be invested. They are better qualified for, and should perhaps be relegated to gambling dens, as they belong to the class of loose-moralled financiers who should be taught better than to look upon insurance as a sort of gambling game, and consequently prevented plying their trade upon a gullible public. It is no help, but a positive hindrance to the proper development of the business that men are retained in the service of Companies whose records are shady, whose lives are corrupt, and whose business is secured because of the reckless promises that are made. The only excuse for it that I have ever heard offered is the desire to keep within respectable distance of others in the race for new business. This is not a justification, and executive officers who do not act voluntarily in the matter should be petitioned by their

good agents to do so, as it is they who have borne the burden and heat of the day in placing a large and desirable business on the books of the Company, and not the shark and sharpers. I should like to see established in this Association an enquiry office where names of undesirable agents could be posted in confidence, and their careers very much shortened. It would be a valuable help. The ill effect, too, of continuing such men in any Company will fall very heavily upon and affect the honest agents in the vicinity of the nefarious operators, quite as much as the Company situate it may be at a distance.

Journals.

Another recognised help is the Insurance Journal. We have many admirably edited journals conveying intelligence respecting Insurance Companies and general matters connected therewith. They are read principally by those in the business. These would do well to extend the circulation, and through this medium educate the public to a fuller appreciation of the great benefits that can be obtained. Ignorance wherever found is a menace to growth and welfare. I regret that there are some journals published that are unworthy of confidence, and which reflect no credit whatever upon the poor creatures who eke out an existence because of the patronage of those desirous of avoiding the arrows of vile slander. They are not educative, they are demoralising and must pass away unlamented. Our Association ought to have a committee to whom unjust attacks could be submitted, with power to recommend united action to the Companies in withdrawing support from any journal adjudged guilty of acting slanderously.

Journal of the Association.

I regret also that our Association has not a journal of its own; the publication of a high-class journal, if only issued quarterly, would be welcomed by every official, agent, and policy-holder as an authentic and consequently interesting publication. Let us hope that this magazine will soon appear, and the interests of Life Assurance be regarded by outsiders as of quite sufficient importance to require it as is now the case with very many of the trades and financial institutions of the country. Several of the Life Companies issue a monthly paper, and I am informed that it is looked forward to with great interest by those receiving

it, and any interruption of its receipt is correspondingly missed. It does not require any advocacy on my part to convince those present of the felt want on the part of the Companies and their adherents of a pure, ably conducted journal, entirely controlled by this Association.

Government Supervision.

Just a word upon Governmental aspects, and I have finished. Life Assurance has received too much attention from legislative bodies. There has been a plethora of legislation. There should undoubtedly be searching periodical examinations by the Federal Insurance Department of the affairs of every Company licensed to transact business. There can be no question that this is ably done under the direction of Mr. Fitzgerald, the Superintendent of Insurance for the Dominion; but it is a hardship, to say the least, that Life Companies should be subject besides to examination and heavy taxation by each of the Provincial Governments. The members of the Legislatures, it would seem, have gone upon the assumption that Companies can afford to pay. Increased revenues have been required and the edict has issued. The authorities have been shown through Committees, headed by Mr. Macdonald in Toronto, by others in Quebec, Winnipeg, and Victoria, that the taxes are upon an entirely wrong and inequitable basis, that the levies are unfair and discriminating in their effects. We may rightly complain of over-legislation respecting the business of Life Assurance, as tending to hinder its healthy growth as much as any one factor we have to contend against. Matters should not be allowed to rest where they are; exertions and representations should be continued to have wrongs righted and federal control extended.

The well-founded idea is timely, and has been enunciated elsewhere, that those engaged in Life Assurance, and responsible to the people, have their good at heart equally with members of Governments, and if this great work of beneficence now being carried on by Life Assurance officials is steadfastly persevered in, it will not be long before men having minds actuarially trained will be sought in the councils of the country as helpers in the solution of vexed questions which will continually arise.

B. HAL BROWN, F.S.S.

Montreal Insurance Institute,
March 13, 1902.

DISEASES OF OCCUPATION.

In regard to dangerous trades, industrial diseases, or diseases of occupation, I would like you to understand that there is, perhaps, a tendency at the present time, by a certain part of the public, to make more out of this class of diseases than is really necessary. Two or three years ago, when I was on the White Lead Commission, owing to several very glaring articles that appeared in one of the London evening newspapers, we were as a Committee sent to visit some of the largest arsenic works in the country, where they make emerald green, which, as many of you know, is a beautiful green pigment. It was used at that time for colouring wall-papers. A statement had been made by some workmen that the arsenic was eating through their fingers, and on a morning, before going to work, they were obliged to tie them up lest they should fall off. I think you will agree with me that this was a very extravagant statement. On examination, we found that the arsenic had caused a certain amount of ulceration, but the cases were nothing like so serious as had been reported. No doubt, if a man is working in an ill-ventilated factory, the effects of arsenic may be very severe, and one has therefore to discriminate very carefully between what is real and what is but the effect of imagination, also how much is due to the occupation and how much to other causes.

It seems to me to-night that I might with some advantage draw your attention to three or four industries that are more or less dangerous.

The uses of Mercury in Mirror-making, Sole-stitching. Quicksilver-mining.

The first that I would allude to is mirror-making, in the manufacture of which large quantities of mercury were formerly used. Glass, as many of you know, is made by taking a kind of white sand that comes from Belgium and mixing it with soda-cake and lime and fusing it in a furnace. The molten product can be poured out to any size, so as to form small or large sheets of plate-glass. In the Middle Ages glass

was extremely costly. I think, beyond the fact that it was found in the churches and in the mansions of the nobles, the smaller houses had practically no windows at all except those holes that were kept open in summer and closed in winter by wooden shutters or glazed oiled paper. Towards the end of last century it was found that glass could be cast. When molten it was poured on to a large table, plate-glass being the result. Until the beginning of this century, or perhaps earlier, mirrors were very primitive. People who wanted to see themselves either looked into a pail of water or they had a silver mirror—a piece of polished silver—or they used a mixture of copper and tin, which gave a very bright reflective surface. The drawbacks to these kinds of mirrors were that they became blackened by exposure, and they were certainly very expensive. It was subsequently found that if a plate of glass was taken and covered by a very thin layer of tinfoil, and mercury poured on the top of it, so as to form an amalgam of mercury, it had a two-fold result. One was that an amalgam was got which gave great reflective power, and, in addition, the substance adhered very firmly to the glass. Now, in the manufacture of this kind of mirror a great many men suffered from the effects of the vapour given off by the mercury. They became mercurialised. The men suffered from tremors, they lost the power in their limbs, and at a very early age they became practically old men. Their teeth also fell out.

It is to the credit of Englishmen—because we sometimes hear of these things coming from Germany—that on this occasion an English chemist found that a substitute could be got for mercury in mirror-making. When passing through the large glass works at St. Helens, in Lancashire, some little time ago, and inspecting the process of mirror-making, I was glad to find men there who had been some years at the trade and who had never been off through sickness caused by the nature of their employment. The method of manufacture in now very simple. The mixture used is a solution of nitrate of silver, to which is subsequently added tartaric acid. When the workman has got his glass thoroughly clean he pours first the silver solution over it, then the tartaric acid, and for a short time he takes care that the glass is kept perfectly steady until the film settles. About an hour after the liquid has been poured over the glass he brushes the whole of the coating with some substance to prevent the action of the air from injuring it. When looked at from the

front it is now a beautiful mirror. If it were only the question of the health of the workmen, the new method of mirror-making is incomparably superior to the old mercurial method. It used to take four weeks to make a mirror by the old method, whereas now one can be made within an hour. The medical profession had so often seen the evil effects of mirror-making upon the health of the people that they have, time after time, at any rate by their protests, shown the advisability of some substitute being found. This has been found, and since the introduction of the new method industrial disease in this particular occupation, viz., mirror-making, has disappeared. Only the other day, in reading *The Times*, I was very pleased to find that in a little place called Fürth, in Germany, where glass-making is the principal occupation in the district, whereas formerly—I am talking about from three to five years ago—there was a loss of something like 1150 days in the year by the workpeople through ill-health caused by mercurial poisoning, there is now, since the adoption of the new method, no loss whatever through this particular disease. This is a highly satisfactory state of things, not only for the workpeople themselves, but for the employers of labour. Mercury is a very subtle poison. The strange thing is that quicksilver cannot be used without its becoming volatilised and the fumes being inhaled by men when at work.

In what is known as sole-stitching in the manufacture of boots by American machinery, thousands of soles are fixed to the upper part of boots in a very short time. In the machinery there is a well which is filled with quicksilver, and as there is generally a considerable degree of heat in the work-room the mercury readily volatilises and the workpeople suffer from the effects of it. Mercury not only produces tremor and excessive salivation—sometimes a pint or two of saliva a day being secreted—but the gums become sore and ulcerated, and there is developed a very unhealthy form of stomatitis, or inflammation of the mouth, accompanied by cachexia, or what might be regarded as an aggravated form of anæmia. The people suffer from bloodlessness, the kidneys are apt to become affected, sometimes, too, the brain. It does not matter in what trade mercury is used, it volatilises very quickly, and the result is usually very serious.

In the case of miners who work in quicksilver mines, they suffer equally readily. All the quicksilver brought into this country during the last few years has come from Almaden, in

Spain. The mines there have been worked for centuries: so, too, has mercurial poisoning existed there for centuries. So serious did the poisoning become, that people could not be got to work in the mines at any price, and the Spanish Government were compelled to send the convicts into them. The result was, of course, that the convict only worked for a few years, and then he, too, became quite disabled. A large part of the quicksilver at present entering England is brought from California. I cannot say what is the effect of working the quicksilver mines in California—I have seen no report. All we know is that the Spanish miners suffered very severely. Good ventilation of the mines and personal cleanliness on the part of the workers do a very great deal to prevent them suffering from the injurious effects of their occupation. It was noticed, for example, in the Spanish mines, comparing the free miners with the convicts, that the latter, who were always kept in the mines and whose habits were dirty, suffered more severely owing to their being deprived of fresh air, whereas the free miners, who could take a day off now and again, did not suffer nearly so much.

A similar series of symptoms has been noticed in men who work at the felt hat trade. A mercurial salt, such as the nitrate, is used in the process of felting. Consquently felt hat makers suffer in the same way as people who are exposed to the vapours of quicksilver—in other words, the mercurial salt is just as severe in its effects upon the system as the raw mercury itself.

Indiarubber Goods.

The next thing I wish to draw your attention to is the making of indiarubber goods. It is only within the last sixty or seventy years that indiarubber has come to be used to any large extent in our industries. It has been known to the Peruvians for a very long time. Although it was introduced into England about the middle of last century, the only use that indiarubber was put to in this country was for rubbing out pencil marks. It was known as *caoutchouc*, which is the Indian name. Indiarubber is the solidified product got from a milky juice that escapes from certain trees in South America. Along the banks of the Amazon there are large forests of these indiarubber trees, and at certain seasons of the year men go out and puncture the trees in various parts, taking pieces of clay and sticking them to the tree underneath the wounds that are made. Cans are attached to the clay

the juice being allowed to run into them. In a short time the juice is gathered. Pieces of wood are dipped into it and exposed to heat. After attaining a sufficient thickness the material, which is known as impure indiarubber, is imported into this country in blocks of various sizes. Up to 1820 it was only used for rubbing out pencil marks. It was at that time an expensive thing. For 2s. 6d. not more than a square inch or so of this indiarubber could be obtained.

Hancock in 1820 turned his attention to this substance and found it possessed certain properties which could be turned to good account. He was the first to make of it such articles as ladies' garters, gentlemen's braces, boots, &c. Mackintosh, of Glasgow, whose name has become associated with waterproof garments, was the first to make these kind of cloaks. He was a poor man, but finding that indiarubber could be used for making waterproof clothing he soon become famous. I have been through the Mackintosh mills in Manchester, and have watched the whole process of this waterproof industry. What Mackintosh showed was that indiarubber could be dissolved in cold naphtha. This is the whole secret of the manufacture of indiarubber goods. The impurities having been taken out of the rubber, it is cut up and cold naphtha is added. This dissolves the indiarubber. Colouring matter is added according to the colour required: if, *e.g.*, black is wanted, lampblack is added; if white, oxide of zinc, and the substance stirred up. The workman stands at a machine resembling an ordinary mangle, only, instead of having a lower roller, a plain surface made of steel, called the knife, is used. Just outside, between the knife and the workman, is a trough filled with the black or white dough—viz., the dissolved, coloured indiarubber. As the roller moves the knife picks up a certain quantity of the indiarubber, which is thinly spread over the surface of the cloth placed there to receive it. Passing on, the material comes in contact with a warm plate, which has the effect of completely drying it. It is subsequently taken to an upstairs room, where girls cut it up into patterns. A visitor cannot go into one of these indiarubber manufactories without being almost overcome by the very strong smell of the naphtha. In some workshops, where the men are always standing close by so as to be constantly watching the operation, arrangements are made for carrying off the naphtha vapours as they arise. Under these circumstances the work is not unhealthy. In many workrooms

the men inhale more of the vapour, but they don't complain much, while in the long rooms, where probably fifty to a hundred girls work, the naphtha vapour is extremely pungent and disagreeable. It is difficult to say to what extent it is positively harmful. If a stranger goes into a factory like this, say about half-past five on a winter evening, when the gas lights are full ablaze, the windows closed, and the rooms overheated, the odour of the naphtha is so strong that it smarts the eyes and he can hardly breathe. The girls themselves are extremely pale. They complain very frequently of headache. In many of these large factories no special provision is made for the workpeople to eat their meals, consequently those girls that come long distances take their food into the workroom. If they attempt to eat it outside the factory they say they are unable to do so owing to the fact that the food is so impregnated with the fumes of the naphtha that they can only eat it in the place in which they are accustomed to work all day. The girls are often, especially on the afternoon of a sultry day, or when the windows are closed and the gas lit, obliged to leave the room and go out into the fresh air. We do not look upon naphtha, though disagreeable and unpleasant, as a dangerous substance in indiarubber manufacture. The process that is dangerous is what is called "vulcanising." If a piece of indiarubber is taken that has simply been acted upon by naphtha, it may be extremely pliable, or perhaps it is hard in winter and unpleasantly soft in summer. It has no lasting power in regard to heat and cold; it is easily influenced by both. Rubber manufacturers have therefore found that to give it qualities that will enable it to stand heat and cold it must be vulcanised. This means bringing the manufactured article into contact with sulphur in some form or other. In some cases, when dealing with coarse goods, all that is necessary is simply to hang the indiarubber up in a close chamber or oven along with some ordinary sulphur. As the fumes of the sulphur ascend they combine with the rubber, imparting to it an elasticity which is characteristic of durable indiarubber, and which enables it to stand the heat in summer and resist the effect of cold in winter. For the production of the very finest indiarubber goods, say such articles as tobacco pouches, children's dolls, or toy balloons, vulcanisation is necessary by what is known as the "wet" method. This consists in dipping balloons, &c., in bi-sulphide of carbon and chloride of sulphur. Now it is this bi-sulphide of carbon that is the injurious substance.

In conjunction with Dr. Bolam, I experimented a short time ago with bi-sulphide of carbon on animals. If we allowed some of the vapour of this substance to be inhaled it made the animal intoxicated. It could not stand; its hind legs went from it. If we increased the dose it simply rolled over like a drunken man. An increased quantity sent it into a deep sleep as effectively as chloroform. It is an anæsthetic just as lasting and powerful as chloroform itself. The animal would be all right in a few hours. Girls engaged in vulcanising indiarubber goods by means of bi-sulphide of carbon suffer from headache; they lose the power of their hands, in fact they also became intoxicated. On the way home from their work they reel and sometimes fall in the street. On reaching home and sitting down, if allowed, they fall asleep, and sleep heavily until awakened. After a meal they go to bed, tired out, and sleep heavily until next morning. It is only after they again come into contact with bi-sulphide of carbon vapour in the factory at the commencement of a day's work that they feel steady in their nervous system and feel able to do anything at all. The bi-sulphide has the same effect as whisky. In the factory the bi-sulphide of carbon is placed in troughs, through which the roll of rubbered cloth for the finer class of indiarubber goods is passed. In one place in London which I visited there were four men looking after two machines; all of them had been paralysed in the arms and legs. Other men had been off ill for months, and if these had not given up their work in time they would have become permanently paralysed in their limbs. The bi-sulphide of carbon is extremely inflammable, and if there is too great a heat in the room it takes fire; so that there is the danger from fire as well as from the effects of the fumes. In another factory I visited, the rooms were constructed something after the manner of a tannery, in order that the fumes might pass out through the roof and sides. There was neither fire-light nor gas-light, the work only being carried on during daylight. It is possible for those constantly working where this substance is in use to become absolutely maddened by its action upon the system, just like absinthe. The result is that the windows have to be barred to prevent the workpeople, in a paroxysm of mania, from attempting to throw themselves from the rooms in which they are working. One of the ways of preventing such a state of things is to carry away from the worker the fumes of bi-sulphide which he might inhale. The conditions

under which labour is carried on in these factories should be such that no girl or man can become the victim of ill-health through following the occupation.

Match-making. Phosphorus is got from bones by the action of oil of vitriol or sulphuric acid, and treating the residuum with charcoal. Phosphorus is sold in sticks, four to twelve inches in length. If it is not kept in water it takes fire. It always emits a strong, unpleasant garlicky odour. Phosphorus is principally used for making matches. There are two kinds—yellow, which is very inflammable, and the red or amorphous, which is not so inflammable. The yellow phosphorus is poisonous, but the red is not so poisonous. In making matches it is estimated that a pound of phosphorus will put heads on to about a million of matches. The phosphorus is taken by the match-maker, and to it are added chlorate of potash, antimony, and glue, with a little powdered glass and manganese di-oxide, also some colouring matter. These are all mixed together by a man who sometimes stands over the composition or paste. The injurious vapours are constantly rising, so that the individual is apt to suffer a good deal. After the paste has been prepared it is taken to the dipping-room, where the wooden splints are placed on a kind of perforated tray, from which one or, in some cases, both ends of the splint project sufficiently to enable the workman to dip them into the composition. The newly-dipped matches are then taken to the drying department, viz., the stoves. In each department, the mixing, dipping, and drying, there arise these fumes, which are extremely injurious to the workpeople.

(At this stage, the lecture was illustrated by a series of views, by means of the oxy-hydrogen lantern, thrown upon a screen. They included pictures of men and women employed in the mixing, drying, and filling of matches.)

Continuing, Professor OLIVER said:—Conflagrations are very common in the manufacture of lucifer matches. During the time I was visiting two of the factories there were numerous small fires at the benches where the girls cut the tipped splints and boxed the matches. These outbursts of flame were, as a rule, readily extinguished. In order to accomplish this, there was placed close to each girl a basin of water and a wet blanket. Were it not for the mutual and timely assistance which the workpeople render

each other the flames would quickly pass beyond their control. The effects of being constantly exposed to the fumes arising from the composition induces a state of the system which is observed more frequently in France than in this country, and is known as "phosphorisme." It is characterised by extreme paleness of the face, a strong, unpleasant, garlicky breath. Albumen appears in the urine. Women seldom go to the full term of pregnancy, and the children, if born alive, generally die soon after birth. There is a very high rate of infantile mortality amongst them. One thing that phosphorus causes in match-makers is "phossy" jaw, due to a necrosis, or death of the bone. There is complaint of toothache; this is usually the first indication of the disease. If the tooth is taken out the pain in the jaw is not entirely relieved, for the fumes of the phosphorus have affected the socket of the tooth; this becomes inflamed, and in time spreads to the bone underneath, causing it ultimately to die. This, in a word or two, is what is known as necrosis of the bone. Phosphorus necrosis is a malady which is naturally dreaded by lucifer-match makers, on account of its painfulness and the fact that it obliges the individual to give up his work. It is strange, considering the knowledge we possess of the evil effects of the use of yellow phosphorus, that the people of this country have not taken more generally to the safety match. In the manufacture of the safety match the red or amorphous phosphorus is used. This is practically free from danger. People engaged in making these matches do not suffer, like those employed in the manufacture of the ordinary lucifer match, from yellow phosphorus. We ought, therefore, to encourage the use of safety matches. When visiting some of the match works in Sweden, I found in certain of the factories that a good deal of manual labour has been done away with. At the Diamond Match Works, in Liverpool, all the work is, practically speaking, done by machinery of the newest type and on the most approved principles. The machinery is most elaborate and almost perfect in its details. The mixing, dipping, and drying are done by machinery. The boxes are also made by machinery; during the process the boxes come out at one end of the machine filled with matches. The great advantage of having matches made under such conditions is obvious. We should have matches either made by this method, or we should go in solely for the use of safety matches, so as to prevent people running risks which, under ordinary circumstances, they are obliged to do.

Lead Mining. Lead mining and coal mining are two of our oldest industries. Lead mining has been carried on in this country since the early part of the Christian era. It is stated by Pliny that in the year 23 A.D. lead mining was carried on in Britain. It was known, however, before the Romans came here, and those who conducted the operations were probably Phœnicians who came over from Gaul. When the Romans came to our country they had a knowledge of mining. We have unmistakable evidence of the extent to which the Romans carried on lead mining in certain parts of Derbyshire. During the past few years not only have people come across mines that had been worked and discarded, showing, to some extent, different methods of mining, but in the mines themselves pigs of lead have been discovered on the top of which were stamped the arms of Imperial Rome and the name of the Governor of the particular district. There are two or three of these bars of lead in the British Museum at the present time. The way in which this lead was smelted was rather primitive. In certain parts of the country there have been found peculiar-looking hillocks. They are simply collections of stones heaped together, and on these stones—always on the western side of the hill so as to get the western breeze—the rude smelters put wood, and on this the lead ore. When the wood was lit and fanned by the breeze the necessary amount of heat was produced to smelt the ore, and the result was that they got the molten lead. The lead originally is found in the earth in the form of veins. It must have got there in one of two ways. Either there had been water on the surface of the earth, and lead which was in suspension or solution had trickled from the crevices in the rocks, or, what is more likely, when the crust of the earth was cooling, subterranean forces were in operation which thrust up the molten metal into the fissures of the rocks. We find veins of lead only in certain parts of the country. The earliest way that lead is supposed to have been mined was by tunnelling into the side of a hill. In the seventeenth century the miners of Saxony began using gunpowder, and they gave the lead miners of this country the hint. Gunpowder is now used very largely in our lead mining. Though not accompanied by the same chances of accident that attends coal mining, our lead mines are poor indeed in their methods of getting the ore compared to coal mines. The unfortunate thing about lead mining is that it is often carried on

by those who have not sufficient capital to develop the mine. Often the owners of lead mines have been working men who have shared the proceeds whatever these were. The result is that there has not been that improvement in the industry which there ought to have been. In the far recesses of a lead mine it is sometimes almost impossible to get a candle to burn, besides the air is so thick with the reek of gunpowder that breathing is rendered uncomfortable. The air is so polluted in the far reaches of the mine, owing to the absence of ventilation, that one candle is of no use, and two candles have to be lit, not so much to get light as simply to get them to burn. The result is that the lead miner, though he does not suffer from lead poisoning, yet runs the risk of becoming bronchitic and asthmatic, the victim of consumption or of chronic rheumatism. He is an old man at the age of forty—crippled in his joints and weakened in his constitution. Many of them die comparatively early. When we consider the dangers of the occupation, and the fact that lead mining is carried on far away in the remote dales of Durham, Cumberland (Swaledale, for instance, in Yorkshire), and at great distances from railway communication, also that these men in their long walks home after a day's work are often chilled and become the subject of cough, it is not surprising that they break down in health at an early age, notwithstanding living in the country. Shut out as they are, too, from the outer world, they intermarry, and thus they form "not only one family socially but industrially as well."

(The various methods of lead mining were here illustrated by means of pictures thrown upon the sheet. The manner of decending and ascending perpendicular shafts was shown to consist either of foot-holes placed in the sides of the shaft, ladders in sections resting at regular distances on a wooden platform, and stemples, or cross bars of wood.)

The lecturer continued: While there have been wonderfully few accidents by men tumbling down the shaft when ascending or descending by means of foot-holes, it is, as seen from the lantern slides, a dangerous means of entering and leaving the mine. Such a method still exists in the sulphur mines of Sicily. The great danger in the "foot-hole system" is that in time the holes wear down, so that if one man slips those below must of necessity be carried down with him.

Let us turn to the sections of the workings. Supposing a man is engaged at the far end of the workings, he carries out his duties

under very difficult conditions. The atmosphere is vitiated with gunpowder smoke. The carbonic acid gas which exists in such large quantities does not tend to make muscular labour easier. After a man has done a hard day's work he walks to the bottom of the shaft and then lifts himself by means of ladders from the bottom. One can imagine the tremendous strain this imposes upon him, for the miner must climb, either by means of foot-holes, ladders, or stemples, a distance three times the height of, say, the High Level Bridge. This will convey some idea of the amount of physical exertion required. It is estimated that the act of simply coming up the shaft is equal to a third of the strength required in the whole day's work, and as this has to be concentrated into a brief space of time, the result is that he lands on the surface tired and heated. After all this has been done he has perhaps a mile or two to walk before he reaches his home. One can therefore see how difficult it is for a lead miner in following his occupation to escape catching cold.

(Pictures were here exhibited showing the effects of lead mining upon the lungs of the worker, gritty particles gradually destroying the spongy nature of the lung tissue. This disease was also shown to be characteristic of the lungs of the Sheffield cutlery grinder and in coal mining.)

Continuing, Professor OLIVER said: Lead mining is less risky, so far as accidents are concerned, than coal mining. I have hinted, on the other hand, that lead mining is very much more serious through the bad ventilation of the pits. Until a few years ago the ventilation in our coal pits was not very good, and when that was the case a large number of coal miners died from consumption. If a few years ago a *post-mortem* examination was made on a coal miner, black pigment would be found in the lungs, or if a coal miner who was suffering from some pulmonary disease was being medically treated he would be found bringing up large quantities of black spit from the lungs. This was due to the particles of carbon that he had inhaled either from the smoke of his lamp or coal dust being returned in the expectoration, indicating that his lungs containing these were breaking up and that this material was being ejected. Since the introduction of improved ventilation into coal pits, which our Governments have insisted upon, the number of miners who die from phthisis is now practically nothing compared to what it was thirty or forty years ago, thus showing what a great deal can be done when Parliament takes

the matter up and its suggestions are carried out in a thoroughly loyal and scientific way.

Coal Mining. So far as coal mining is concerned, I would like to mention one circumstance. The coal miner runs risks which the lead miner does not in the matter of explosions. Some coal pits are extremely fiery. This is owing to the existence of marsh gas, or fire-damp, which ignites very readily. But there are other gases met with in coal mines, which, when inhaled, cause poisoning of the individual and bring about a condition of asphyxia, which, if not relieved, ends in death. Some of these gases found in coal pits after an explosion are very dangerous to individuals. One of these, if inhaled for a length of time, is invariably fatal in its effects. This gas is known as carbon monoxide, an entirely different gas to carbonic acid. The two have not the same effect upon the individual. Carbonic acid interferes with regular respiration and causes it to be difficult, whereas carbon monoxide produces deep sleep, in which the individual passes into a state of coma from which he may not be able to be roused. The man who dies from breathing carbon monoxide, dies because he cannot get his blood to take up oxygen from the air. For instance, a tramp going through some of the colliery districts in the North of England seeks shelter and warmth for the night, it may be close to some coke ovens. He lies down to sleep, and in a short time he is soothed by the warmth. More than that, he keeps inhaling the fumes which arise from the burning coke, and next morning he is found insensible or dead. That individual has had his blood impregnated with this carbon monoxide and become asphyxiated.

(Pictures were here thrown upon the screen showing the results of a series of investigations with the spectroscope in regard to the different conditions of human blood. According to the presence or absence of one or two dark bands in the spacing between the yellow and the green, so was the colouring matter of the blood more or less charged with such injurious gases as carbonic acid and carbon monoxide. The experiments showed what it was in the blood that absorbed the oxygen of the air, while at the same time the bright red or very dark colour proved the blood to be the arterial or the venous.)

Referring to the nature of explosions in coal mines, the lecturer concluded: Supposing that during mining operations the shot

employed is not sufficient to bring down the rock, it might still cause an explosion if there were any fire-damp in that particular part of the mine. It is now known that coal dust can exist in a very fine state of division, and unless the workings are kept damp by means of water an explosion will probably result from the discharge of the shot. It has been found that when an explosion occurs in a coal mine any deaths which result from it are due to two causes. Some bodies have been found so burnt on the surface that there is no doubt the men died from the injuries and burns they received. A large number of the deaths, however, is not due to either injuries or burns, but owing to the miners having inhaled carbon monoxide gas. In the wake of a colliery explosion this monoxide gas is formed. The tendency of the miner is, after an explosion, to make his way if he can to the bottom of the shaft. It is unfortunate for him that he takes this course, because it is that part of the pit where danger is the greatest. On trying to make his way to the bottom of the shaft, where doors have been blown down and props broken and many obstacles cast in the way, blocking up the means of exit, he becomes heavy, then tired, and in a short time he is entirely overcome by the gas, and ultimately falls on his face. This is due to the fact that the air in the passages is laden with carbon monoxide. The interesting point about these cases is, where a man has been working in a coal pit and is exposed to carbonic acid gas, he experiences some difficulty in breathing, and then his lamp goes out. The very fact of the lamp going out should be a sufficient warning to the miner to retire from that part of the mine. On the other hand, where the gas is carbon monoxide the collier's lamp still goes on burning, yet the miner becomes sleepy and tired, he has peculiar sensations, and while he tries to get away from the place he is overcome, falls down, and when found by his comrades is perhaps dead or insensible, his lamp still burning beside him. The going out of the lamp, therefore, is a warning in the one instance, but in the other, viz., exposure to carbon monoxide gas, there is no such warning. The question naturally arises, is there no means by which the individual can be made aware of danger in time to escape? Dr. John Haldane, of Oxford, has paid a great deal of attention to this subject, and he has suggested that every man engaged in getting coal in a gassy seam should take a white mouse with him. This animal is peculiarly susceptible to the influence of carbon monoxide gas,

and when exposed to it will die in a few minutes. Now, the doctor estimates from the size of the animal, and the rapidity with which it is poisoned by the gas, that there is always an interval of from twenty minutes to half an hour after the mouse dies to the time the human subject will be overcome by the same cause. He says, therefore, that if those men who work in dangerous mines would take a white mouse with them in a small cage it would prove a safe guide and an indication to retire when danger threatened. The half-hour that elapses after the death of the mouse would prove a sufficient length of time for them to make their escape.

Professor OLIVER, at the conclusion of the lecture, expressed his indebtedness to his colleague, Dr. Bolam, for his valuable assistance in illustrating the lecture, and also to Mr. Muirhead, who, at some personal inconvenience, had also helped.

PROFESSOR OLIVER, M.D., F.R.C.P.

Newcastle Insurance Institute,
January 29, 1897.

HEART DISEASES IN THEIR RELATION TO LIFE ASSURANCE.

In the first place allow me to thank you for the honour you have done me in asking me to read a paper to you upon this difficult subject; and, whatever the present difficulties may be, they are likely in the near future to increase, when, as appears probable, "invalid lives" will be accepted in larger proportion than is the case to-day.

In addition to a thorough knowledge of medicine a Medical Examiner for Life Assurance requires some special knowledge and much experience. It is so much a commonplace as hardly to be worth reiterating, to say that in endeavouring to formulate my special knowledge I regret the absence of valuable information, which the Life Assurance Companies alone have it in their power to impart. I never hear, unless accidentally, whether a candidate whom I have examined has been accepted or rejected; and yet the information would be of much value for future guidance. I never hear whether "lives" that I have recommended for acceptance have fulfilled their expectation, or have died prematurely. No doubt, this would entail trouble and some expense; but the value of it would be considerable, and more, eventually, to the public and the Insurance Companies than to the medical profession.

To enable any accurate value to be placed upon invalid "lives" (*i.e.*, "lives" in which the history or the physical examination reveals a departure from an accepted standard), it is mainly to the records of the great Insurance Companies, which deal with large numbers, that we must turn for information. It is largely outside the scope of clinical medicine, and the most extensive experience of hospital or private practice is not sufficient. But further statistics of this nature must be obtained before, for instance, the value of "lives" with damaged hearts can be properly appraised.

Heart diseases in their relation to Life Assurance may be considered in two categories, which, however, overlap in many places.

First, those which entail total rejection; and second, those which will allow acceptance at an increased rate, or for a limited period.

The first category is greatly the larger and more important; the second the smaller and more difficult. It would not be difficult to set up so severe a standard that few would attain to it. Probably, hardly any of that few would die of heart disease; and in that respect few mistakes would be made. But, on the other hand, very many of those rejected would not die of heart disease either; and, consequently, such a rigid system of rejection would be unfair to the candidate, and would unduly limit the *clientèle* of the Company.

When an examiner is over-anxious not to overlook anything in examining heart cases the tendency is to reject unnecessarily. It cannot be too earnestly realised that there is no cast-iron standard which a candidate of necessity reaches or fails to reach. The human body is too delicately balanced, and too readily adaptable to its environment, for that to be possible. There are many slight differences and abnormalities which must be accepted as coming within the average standard of health.

Before entering upon the varieties of heart diseases as they affect Life Assurance I must say something upon the question of heredity.

Heredity plays a smaller part in the consideration of heart affections than is the case in many other diseases; but it is not to be entirely neglected. Some people are by inheritance large-hearted and possess a considerable reserve of power. They make good athletes, and stand wear and tear well. Some are constitutionally small-hearted and are soon exhausted by exertion.

An exactly similar injury or disease of the heart in different persons may cause great constitutional disturbance or little; may run a rapid course or a slow one, according to the inherited vigour of the patient.

Acute Rheumatism—one of the most common causes of heart disease in early life—shows certain family proclivities.

A tendency to degeneration of blood vessels, or to kidney disease, may be inherited, and these are very important causes of heart disease in later life.

I cannot in the time at my disposal enter exhaustively into the numerous forms of heart disease, but I have divided them roughly into four classes for the purpose of the present lecture, namely:—

1. Nervous diseases.
2. Cases with murmurs (valvular diseases).
3. Hypertrophy and dilatation.
4. Degenerative diseases.

1. In the first place we will take disorders of the nervous mechanism of the heart. These are mainly too rapid action (tachycardia), too slow action (bradycardia), irregular action, and intermittent action.

No person whose heart's action *remains habitually* faster than 90 or 100 beats per minute is insurable on any terms; nor anyone whose heart's action is habitually irregular, even without any other discoverable disease. But both these conditions are apt to be simulated by mere temporary nervousness during examination. It is very common for the pulse rate to quicken 10, 20, or even as many as 40 beats per minute from nervousness during examination, and indeed to be accompanied by palpitation or irregularity. But all this subsides in from 10 to 15 minutes, or on lying quietly on a sofa for a short time. Such cases can be passed as free from disease, though I doubt if they are so well fitted to stand the wear and tear of life, and fight their way in the world, as others whose pulses do not quicken a single beat from the unwonted ordeal of a medical examination. It does not at all follow, however, that they will die of heart disease. The probabilities are against it.

Two illustrations may be instructive:—

A personal friend whom I have attended professionally at intervals for the last 15 years was examined for Life Assurance as a young man many years ago, and nearly fainted when a stethoscope was applied to his chest to ascertain the condition of his heart. He might not improbably have been rejected had he not had the opportunity of explaining to the Directors that he had quite recently won the 100-yards race at Oxford, and was able to run, ride, or shoot with anyone. He is now in his 78th year and remarkably active.

A few weeks ago I was examining a young probationer nurse, about 25 years of age, to ascertain her medical fitness to be admitted to the permanent nursing staff of the hospital. She had come with a certificate of good health, was tall, well developed,

and weighed between 10 and 11 stone, but was slightly anæmic. What was my surprise to find the heart acting quite irregularly, no two beats being alike in force or rhythm. Believing the irregularity to be due simply to nervousness I directed her to rest on a sofa while I examined one or two others who were waiting. In ten minutes' time the heart was quite regular and acting strongly. She showed no disease of any kind beyond the slight anæmia already mentioned.

Irregularity to that extent from nervousness alone is by no means unknown in the male sex, and I am informed is not infrequently met with during the examination of recruits for the army. As I have said, they are, probably, not quite such good lives as the less emotional ones, but it would be quite unreasonable and unnecessary to reject them.

Marked slowness of the action of the heart—that is to say fewer than 50 beats per minute—is somewhat rare; and each case would have to be judged on its merits by a competent authority.

The only cases likely to give rise to difficulty are those of excessive nervousness when the rapid action borders closely upon true tachycardia—a serious disease, in which the duration of life is seldom very long and may be terminated suddenly.

2. *Cases with Murmurs.* *Valvular diseases* will form the bulk of the heart cases rejected during an examination for Life Assurance, and some of them will also form the large majority of those which might be accepted as second or third class lives. The total of cases with heart murmurs suitable to accept as second-class lives will remain somewhat small, and it must always require much special knowledge and experience to decide which cases may safely be accepted.

It is far simpler to reject every case with any kind of "murmur," whether really indicative of valvular lesion or not; but, undoubtedly, in that way injustice is apt to be done, and business is restricted.

In not a few people a murmur is audible in the region of the heart, and they are certainly not only free from valvular disease, but also free from any other serious disease likely to shorten life. They cannot be said to be absolutely first-class in the sense that they are free from any flaw whatever, but they are likely to attain to the duration of life to be expected from their age.

The two most numerous classes of this description comprise

cases with exocardial murmurs, which, however, are oftentimes difficult to distinguish from endo cardial ones.

a. Men with large hearts, acting strongly from exertion or excitement, not rarely develop friction over a small area between the visceral and the parietal pericardium. The result is a systolic murmur audible over the middle of the right ventricle and frequently mistaken for an indication of mitral regurgitation.

The pericardium, if accidentally seen *post mortem*, shows a small, opaque, white area, pictorially described as a milk spot, but not known to be of any prejudicial significance.

Cases in which there has been definite pericarditis, and in which a permanent friction murmur remains, or in which there are signs of adherent pericardium, fall into a different category. No one would suggest accepting them as first-class lives, but some few could be accepted as second or third class lives at special rates.

b. Young men, subject to palpitation from nervousness or from exertion frequently develop what is termed a "cardiac respiratory murmur"; and much discussion has arisen upon the unnecessary rejection of candidates for the army from this cause. It is believed that the murmur is not produced within the heart at all, and, therefore, is not an indication of a defect of any value. It is believed to be due to air driven out of a portion of lung squeezed between the heart and the walls of the chest at each contraction of the heart towards the end of inspiration. They might be accepted at ordinary rates, or with a very slight addition, for experience shows that they do not go on to genuine heart disease, although they are probably less robust than their fellows and less capable of enduring fatigue. Another class of murmurs, most of which do not indicate any permanent heart-lesion, and, therefore, do not warrant total and permanent rejection from Life Assurance, are the anæmic murmurs. They are found chiefly in young women, who do not insure their lives in any large proportion. Of course, the anæmia would need to be cured before the "life" could be accepted; but many cases in which the "anæmic" murmur is slow in disappearing might be accepted as second-class lives at increased rates. It is a very common experience to meet ladies from 50 to 70 years of age who have been said to have had serious "weakness" of the heart 30 or 40 years ago, and who in consequence have lived somewhat careful lives. There need be no difficulty in insuring such cases, if necessary.

Another class of cases insurable with a small addition to the premium are those in whom a murmur is audible only after exertion, or in one position—usually the recumbent position.

Probably many such murmurs are missed, as it is quite unusual, unless there is some other reason to suspect defect in the heart, to ask a "proposer" for Life Assurance during the medical examination to run up and down stairs, or to lie flat upon his back—both tests it is sometimes necessary to use. Such murmurs may be temporary, or, if permanent, may indicate very slight and non-progressive valvular defects. These points can be cleared up, if necessary, by a re-examination in six months or a year's time.

When we come to the plain and undoubted cases of valvular disease a different attitude must be assumed. Under present conditions I should say that the very large majority must be rejected even as second-class lives, at any rate for whole-life policies.

For short-period policies payable on attaining a given age—say 45, 50, or 55—they might be considered much more favourably.

It cannot be too widely known that the course of cases of valvular disease varies within very wide limits. Some progress rapidly and steadily to a fatal termination. Others, and they are numerous, progress irregularly, with quiescent intervals. Many, again, having reached full compensation, cause extremely little constitutional disturbance, are non-progressive, and are quite compatible with active, vigorous life. Such persons sometimes hunt, shoot, and even go through a military campaign. Many workmen follow a laborious occupation for years under such conditions.

More than twenty years ago the late Sir Andrew Clarke called attention to a class of cases of mitral regurgitation, which he showed to be very numerous, in which the valvular lesion was non-progressive, and the patients were able to enjoy an active life for many years. He pointed out that in such cases the powers of activity and duration of life of the patients were more favourable than either the public or the profession fully realised.

But if the necessity should arise to insure such cases, very great care and judgment will be necessary in their selection.

I would not accept upon any terms any case of aortic regurgitation, mitral stenosis, or syphilitic heart disease.

May I add here that in my opinion a distinct and separate

question should be included in the list of questions to ascertain if the proposer has had syphilis? In that case the question could be put by the Medical Examiner with less risk of giving offence.

In cases of mitral regurgitation I would only accept those occurring in young people—say under 30 years of age—when the cause (*e.g.* rheumatism), if known, has ceased to operate, when the lesion has remained stationary for a year, and when compensation is perfect and likely to remain so.

I have a very vivid recollection of a young man, aged about 19, with extensive mitral regurgitation due to previous acute rheumatism, who was accustomed to row upon the Trent in winter, and even take part in races. That is ten years ago, and he is still in good health and conducting a large business.

I also know of a young football player who was warned that he must give up football on account of a valvular heart lesion, who has for five years since that date played in first-class matches.

A nurse, who about eight years ago suffered from two attacks of acute rheumatism, complicated by pericarditis and endocarditis, and leaving a double aortic murmur, now follows her exhausting occupation with conspicuous success, and has only the slightest trace of a murmur remaining.

Very exceptional cases with an aortic systolic murmur in quite young subjects might be considered.

Other valvular lesions are not sufficiently common to be considered as a class, but each case must be judged on its merits.

3. Another class of cases not infrequently coming before us for Life Assurance consists in what has been termed "overstrain" of the heart in otherwise robust, healthy adults. It is associated with excessive indulgence in athletic exercises, especially when out of training, or when not originally of sufficiently robust fibre. The exact pathology is not as clear as we could wish. Sometimes "overstrain" consists in an enlargement in which dilatation is in excess of hypertrophy, and there is valvular leakage. In other cases the dilatation is not so evident, but some obscure nervous derangement has taken place. This is well illustrated by the so-called "irritable heart" which was very common, and very well described, in many of the soldiers of the American War. In civil life the most common causes are unwise indulgence in rowing, football, and running—especially excessive competition in racing—during school and college life. At a later period excessive bicycling

is a common cause, especially riding too much or too quickly up hill, or for great distances.

Many of these cases are curable, and may live to old age, though with enlarged hearts. In some the beginning of permanent and serious heart disease has been laid.

The suitable cases require selecting with much care, particularly when it is remembered that candidates for Life Assurance do not like a prolonged examination, with elaborate mapping out of the size of the heart by percussion, to ascertain the degree of enlargement.

4. I have by no means exhausted the number of diseases of the heart. There are many others, chiefly of a degenerative nature, developing mainly between 40 and 65 years of age, and associated with thickening of the blood vessels, kidney disease, excessive *eating* as well as drinking, and the general wear and tear of modern life at high tension.

You must not suppose that in all, or indeed in any large proportion of, those whose lives have been insured, and who eventually die of heart disease, there has been an error in the examination and the disease has been overlooked. In the majority it has developed after the examination, in the way I have just described. In some, no doubt, a suspicion of undue liability to heart failure may have arisen, but candidates cannot be rejected on suspicion unsupported by some definite facts.

As you are well aware, both thickening of the arteries and kidney disease are most carefully searched for in all Life Assurance examinations, and are sufficient causes for rejection. But if, in the absence of evidence of either of these, a doubtful heart condition were found in a candidate of 40 years of age or upwards, it would be wise to reject him, as the condition in all probability will gradually, but steadily, become worse. Whereas the liability to consumption decreases with age, the exact contrary is the case with most (not all) forms of heart disease. The risk is an increasing one. Almost inseparably mixed up with diseases of the heart is aneurismal enlargement of the large blood vessels within the chest. It is not very difficult to detect, and is an absolute bar to insurance on any terms. It is rare before 45, after which insurance is not very common; but is found occasionally from 35 onwards, and then almost invariably is due to syphilis.

Another disease I ought to mention is angina pectoris. It very rarely comes on until after the age at which insurances are

usually effected; but would be, of course, an absolute bar to insurance. There is, however, another disease—pseudo angina, or false angina—very closely allied to it, and occurring in much younger subjects. It is the cause of much less danger, and would not necessarily in all cases preclude insurance.

I have, perhaps, entered too much into technical and medical details, but I have not seen my way to avoid that in a medical subject. I am anxious you should thoroughly realise that "heart disease" is not a simple and single entity, but that there are many kinds, many degrees, many combinations, and that individual cases present infinite varieties and complexities.

All the Offices for which I examine will only take *first*-class lives. The rejection of doubtful cases becomes, therefore, much simpler. When a sufficient demand arises for the insurance of distinctly damaged lives (for example, lives with a recognisable heart defect) there will be no insuperable difficulty either in diagnosis or in appraising the value of such lives, though it can never be easy. It will probably take the form of endowment policies for short periods—10, 15, or 20 years, or even shorter periods. The rates must naturally be high, and consequently the amount of business limited. But strictly as an insurance to compensate for death within a given period there must be many instances where it is worth while to pay even very high rates to equalise risks.

HENRY HANDFORD, M.D., F.R.C.P.

Nottingham Insurance Institute,
February 7, 1902.

AN ENDEAVOUR TO ESTIMATE THE VALUE OF CERTAIN DOUBTFUL LIVES FOR LIFE ASSURANCE.

My intention is to demonstrate that certain lives, undesirable on account of family history, and possibly personal condition, may nevertheless be dealt with in a manner satisfactory to the Company and also to the applicant. The plan to meet these difficulties may vary in detail, but the main idea is the same in all.

In scanning the examination papers, we find that certain families show at certain ages a marked tendency to cerebral disease, evidencing at one time apoplexy or paralysis in their forebears, or cerebral softening or mental disease in some form. Other cases show sudden death from heart disease, not clearly explained—heart failure it is sometimes called—at late middle life. Associated with this may perhaps be found a case, possibly two, of Bright's disease.

Another applicant's forebears may show an aneurism in the chest, or a gangrene in the leg, as responsible for the deaths, and we may find evidence of gout or rheumatism.

If, in combination with any of these family characteristics, we find a personal examination suggesting in early middle life a confirmation of the tendency shown in the family history, we should be very careful in weighing all the facts before arriving at a decision that the risk is eligible. It is often possible to meet the unfavourable features by some modified form of policy, suggested by actual or business experience.

In the family history of the types I have suggested we have disease in widely different organs, but in a large degree there is the same underlying cause for them all, viz.: a peculiar degeneration in the arterial system, to which the name arteriosclerosis is given; but here I find myself in a difficulty. If I were addressing a medical society I could think and speak in medical phraseology with much greater ease to myself, but as the

medical fraternity is probably in the minority, I propose to explain in non-technical language the vascular system and the changes wrought in it, so that all may follow and be able to add their quota in solving cases which to a non-professional eye seem little removed from a safe and satisfactory risk.

Last year the subject of longevity was ably handled before this Society, and many facts bearing on it fully set forth. A good many years ago a Frenchman summed up the question in a brief sentence when he said: "A man is as old as his arteries." Professor Osler, of Baltimore, rightly regarded on this continent as one of the highest authorities, says longevity is chiefly a vascular question. Do we not then do well to look closely and see if the vascular system of an applicant, as shown in his person and in his family history, is likely to stand the stress of this modern strenuous life of ours, specially telling upon those who control large financial interests and who often seek large insurance; also politicians and professional men, especially if their career has been one of marked success. Not long ago, in a paper read before the American Association of Life Assurance Surgeons, Dr. Talbot Jones characterised arterio-sclerosis as the greatest foe of Life Insurance Companies, and complained how little regard had been paid to it in the construction of existing mortality tables. I find, looking at the table of the Mutual Life Insurance Company, of New York, that while tuberculosis heads the list, if all the cases that might reasonably fall under the broad term of arterio-sclerosis were grouped, tuberculosis would fall to the second place, and yet while all agree that tuberculosis is to be carefully scrutinised, it is questionable whether the same care is exercised in the class of cases we are now considering.

Bear with me, then, in my endeavour to describe as briefly as I can the arteries and the changes effected in them by disease.

The walls of the arteries are composed of three coats, external, middle, and internal—the external of strong, tough, elastic tissue; the middle of both elastic and muscular tissue. The proportion of these two elements varies in different arteries, the elastic preponderating in the large vessels where the first strain of the force-pump action of the heart tells, and the reverse in those smaller and more distant. This elastic tissue guards, then, the large vessels from the suddenly exerted pressure to which the heart subjects them every time it beats, and they are for the moment holding more blood than they can discharge into and

through the minute vessels. Under the pressure they dilate, and in doing so become tense and resisting, and if the tube were brittle this force might burst it. By yielding, the force of the shock in propelling the blood is broken and exhausted before the vessels are in danger of rupture through being over-stretched. Elasticity, therefore, is advantageous in all arteries, but chiefly in the larger ones. On subsidence of the pressure they resume their former calibre, and thus equalise the pressure of the blood current by maintaining pressure on the blood in the arteries during the period when the heart is at rest. No force by this arrangement is lost, for by the law of elastic bodies they return to a state of rest with a force equal to that by which they were disturbed. There is no loss of force, nor any gain, because just as a spiral spring would not shorten itself if it were not first elongated, so the arteries only restore that which they receive. The muscular coat assists in a small degree in propelling the blood forward; its chief office is to regulate the quantity of blood supplied to each part. Each organ or part, according to circumstances, requires more or less blood at different times. Thus the brain awake and actively working requires much more blood than if asleep and inactive. This the muscular coat regulates by contraction, so as to diminish, and by passively dilating or yielding, to permit of increase. The internal coat is formed by layers of elastic tissue, and a thin inside brittle coat, lined with a delicate layer of epithelium, which makes it smooth and polished and gives an almost watertight surface, and enables the blood to flow with the smallest amount of resistance from friction.

Such a perfectly adapted set of vessels time gradually alters, so that when age is reached very often the elasticity and contractility are lost and the vessels converted into rigid tubes, and having lost their power of recoil, they yield before the distensive power of the heart and become elongated and dilated. The changes in the coats, which affect all three of them, are interesting, but time will not allow me now to refer to them. Gradually these changes produce results which have long been recognised, but the idea of a general disease of the vascular system, arterio-sclerosis, or arterio-capillary fibrosis, as Sir William Gull calls it, is comparatively recent. These changes in the vessels, due to the wear and tear of time, are usually found in those of advanced years, but not infrequently a general form is found invading many of the vessels at a comparatively young age, so

that a man aged 30 may have the vessels of a man of 60. Such a condition might possibly be traced to heredity. Bad material, as Dr. Osler says, was used in the making-up of the tubing of the machine; the vital rubber in the vessel wall was of poor quality, unable to stand wear and tear, and early gave out. Unfortunately, it may in some instances be found that good, or at least fairly good, vessels have become deteriorated from bad usage. Many causes are assigned for this, such as alcohol, gout, syphilis, kidney disease, overwork of muscles, and over-eating, especially in people who take little exercise. In such cases, if degeneration occurs in the large vessel near the heart—the aorta—we find dilatation or aneurism, to the danger of which it is unnecessary for me to refer.

If the brain suffers, persistent headache, giddiness, sudden alteration of speech, one-sided palsy or hemiplegia, may be the indications. Not infrequently the vessels supplying the heart itself with blood are affected; their calibre is diminished and the walls of the heart suffer partial starvation. In such a case a spasm of the arteries may occur, and that dreadful and to be dreaded group of symptoms known as angina pectoris, or breast anguish, result, or even rupture of the heart may happen, occasioning instantaneous death. The kidneys also are liable to degeneration; the organs waste for want of a proper blood supply, which reacts on the heart, causing it to put forth more exertion; hypertrophy or enlargement results. It would be easy to multiply examples, but these may be sufficient to show how the great vital organs are liable to suffer from arterio-sclerosis, or degeneration of the blood-vessel walls.

Can we make a diagnosis of this affection in an applicant sufficiently early to be of practical use in estimating its value as a special danger in Life Assurance cases? There is one period in the life of such a class where it is difficult owing to the poverty of symptoms from which observation has to be made. At a later period, when the effects upon important organs become visible, it is comparatively easy. An observer should look for a high-tension pulse; a hard vessel wall, making a firm pressure necessary to obliterate the pulse; a slightly displaced apex beat; an accentuated ringing second sound of the heart; presence of an arcus senilis. This is the stage when it would be very helpful, but possibly difficult, to secure a really thorough examination. The place may be ill-adapted for it; the insurer, possibly conscious of some defect,

wishes the examination to be as superficial as his frequent objections can make it; and the result is that a diagnosis of arterio-sclerosis is seldom made until its effects begin to show on important organs. With the family history we may be more fortunate. Sometimes very complete and satisfactory details of family history are available, and the extent to which they impair the value of a risk varies in different cases. I have purposely avoided in this question of diagnosis mentioning the sphygmograph as an aid. I hardly think it is likely to be available on ordinary occasions. It requires skilled hands to use it, otherwise disappointing and contradictory results may follow. The paper by Dr. Talbot Jones, to which I have already alluded, gives a symptom copied from one of the German journals of June of this year by D. Friedman, who says: "When the descending aorta is ascultated from the rear, the sound is heard most distinctly at a point which becomes constantly lower with increasing age. In case of senile involution and of arterio-sclerosis at any age, the sound is most pronounced at a point on a level between the lower corner of the scapula and the seventh dorsal vertebra. The second aortic sound is most distinct. A groaning sound at the angle of the scapula can therefore be accepted as the direct initial symptom of an arterial affection, constant even in the incipient stage." I have no practical experience of what value is to be attached to above.

Let us sum up the whole matter. How are we to deal practically as Insurance men with these cases? It is not easy to answer the question, and the opinion I shall express may be quite open to discussion and wide difference of views:—

1. If an applicant shows strong evidence of arterio-sclerosis in his family history, and also under personal examination, he is not insurable on any terms.

2. If a man has no evidence of arterio-sclerosis in his family history, but has the disease in important organs like the brain, the kidney, or the heart, unmistakably shown by symptoms characteristic of these several states, while they may not involve grave imminent danger, he is nevertheless an undesirable risk, and most Companies would, I believe, do well to leave him alone, or take him on a short endowment only, depending on the gravity of the lesion found.

3. If arterio-sclerosis is markedly shown in the family history, but a rigid examination has failed to disclose any evidence of its

presence in the applicant, an endowment terminating before or about the period in which this proclivity is most shown might be offered.

4. If the family tendency seems inclined in the direction of arterio-sclerosis, but the personal examination is good, perhaps a life policy paid up in 10, 15, or 20 years might be offered; but special consideration should be given to every case.

F. LeM. GRASETT, M.B., F.R.C.S. Ed.

Toronto Insurance Institute,
December, 1901.

PERSONAL ACCIDENT INSURANCE.

UPON receiving from your important Institute a request to read a paper upon Personal Accident Insurance, I found myself at once in a serious dilemma. It was a request which I naturally felt to be an honour to receive, and therefore one which I did not feel at liberty to decline, and my difficulty arose from the fact that the subject is one upon which I could speak for a long time, but also one about which a very great deal has been said and written during the past few years, as the records of your own Institute and of the Federation of Insurance Institutes show.

Naturally it would not be interesting to you to hear repeated what you have already heard as to the very early history of the attempts to commence this class of business. Suffice it to say that from the small beginnings of the payment of a few pence at railway stations for an insurance against the single contingency of the happening of an accident during a particular journey, there has been patiently built up a volume of business which has attracted the notice of some of the powerful Life and Fire Insurance Companies, and has caused them to enter the field, which after all has been a somewhat restricted one, and since the passing of the Workmen's Compensation Act is very much narrowed, seeing that if those who are employed can recover from their employers compensation for injuries received during their occupation, they are not so anxious to involve themselves in a payment to secure the protection which we think necessary for them.

Now it appears that into this restricted field there has come an enormous capital seeking employment. In the early times there was a paid-up capital of only a small amount, and for a period it was possible to earn a fair dividend and to build up some reserve funds, but as time went on the profits arising from this class of business diminished, owing apparently to several causes.

Firstly, to the increasing activity of the public, as evidenced by the rapid growth of outdoor pastimes and the improved means of

locomotion, assisted by the enhanced opportunities for recreation, caused by the shortening of hours of business and the multiplication of holidays.

Fifty, forty, even thirty years ago, when it was possible to secure a profit in this class of business, the middle-aged or elderly professional man, or member of the mercantile classes, did not, as a rule, engage in active exercise involving risk, and the shopkeeper, before the days of early closing, was engaged longer hours in his shop.

The members of this Institute heard in 1899 that the rates for accident insurance at that time were practically the same as "forty odd years" before, and therefore you will readily understand that there is not nearly the profit in them now as then: the chances of an accident, which were annually one in twelve of the policyholders, have risen to be one in ten, and in these days of electric street tramways, of cycles and high-speed motor cars, are rapidly rising to a much larger proportion.

Secondly, the diminution of profits arises from the liberality of the Accident Companies themselves, in giving to their policyholders very much larger benefits than formerly: in witness—

(*a*) Reduction of premium after a certain number of payments,

(*b*) The payment of capital sums for the loss of one or more eyes or limbs,

(*c*) The opportunities now offered for over-insurance, and therefore exaggeration of disablement, and even fraud.

It is probably under the heading (*b*) that more frauds have been perpetrated or attempted than any other. In my own experience I have been obliged to expose the weakness of many claims for the alleged loss of an eye. One of the cases particularly comes to my remembrance, but it is also associated with (*c*), as the individual had effected insurances in two other Companies, thus providing for £1500 in the event of the loss of one eye. The result of the investigations of the representatives of the two Companies and myself was that nothing had to be paid, and the individual in question was last heard of as a starving wanderer in America, while a companion, who assisted him, in an interview we had, received severe sentence in connection with some frauds on Fire Insurance Companies.

Well, into this field there has come a paid-up capital—paid-up, mark you—of over six millions sterling, seeking a profit towards the dividends, with over seventeen millions subscribed, but at

present uncalled, with reserve funds of over three millions. Certainly a grand security for the policyholders, but what an example of over-production! What is the result? A net underwriting surplus which is diminishing by scores of thousands of pounds a year. Why should the Insurance Companies waste their funds by acting almost as philanthropic institutions for the benefit of policyholders, instead of obtaining a fair premium for the risk they underwrite?

It is not in the early years of Accident Insurance Companies, or in the early periods of indemnity underwriting, that the liabilities accrue; records show this conclusively. After a time it is found, especially so in years of severe frost, that the loss under personal accident policies, coupled with the bonus reduction of premium, works out that the policyholders receive back 70 per cent. of their premiums. Now, as the working expenses of Accident Companies are many of them over 40 per cent., nearly all over 30 per cent. (it is only by very rigid economy the expenses can be kept under 30 per cent.), it follows that the profit on this class of business is but small, and the margin left for heroics, or for fresh benefits to the insured, is small in the extreme. The dividends paid by some of the Companies are largely obtained from the interest on the investment of their capital or funds built up in happier times, or from other sources, particulars of which the Companies keep secret.

Another reason for the diminishing profit is to be found in the fact that policyholders grow older, and it is difficult, if not well-nigh impossible, with any regard to the popularity of the business, to cease to receive the offered renewal premiums. Many fatal claims which have come under my notice arose from the deaths of persons of 70 years and upwards, even unto 90 years of age.

We ought to have a clear conception of the meaning of the term "accident." There are in these days very many persons to whom betting is not unknown, and who, if it were possible upon the announcement of the result of a race, might make a large sum of money if they could get some unwary people to lay odds against the winner. From a claim which has come under my notice it almost seems that there are people who consider that Personal Accident Insurance is provided for those who know a "dead cert." A member of the gentler sex had the misfortune to receive an injury which necessitated an operation; the operation proved only partially successful, and some time after the healing

of the wound it was found necessary for a further operation to be performed. This caused a period of total disablement, but in order to be recouped her expenses she took the precaution to insure a few days before the surgeon was required, and during the inevitable incapacity she promptly sent in a claim. She was much hurt upon my informing her that the policy was not retrospective. Again, it is not an uncommon thing for applications for compensation to be made by, or on behalf of, persons who have been stated to have had the intention to insure, but for some plausible reason or other have not even initiated the necessary contract.

It can be said with certainty that the term "accident" does not apply to the above-mentioned class of cases. The Personal Accident Insurance—"Insurance," you observe, not "Assurance," because it is a provision against a contingency which may not arise, not simply a contract providing something in an inevitable event, such as death—is a provision for compensation or recompense at the agreed rate, in case of disablement or death arising from personal injury caused by chance, by an unusual effect of a known cause and therefore unexpected, by fortuitous circumstances, by an event which proceeds from an unknown cause, by casualty, by an event which takes place without our foresight or contrary to our expectation.

Now it frequently happens that during the illness, more or less protracted, which precedes the dissolution of the body and soul, there are slips or falls arising from pain or weakness which do not in any way affect the momentous event which is taking place, or is shortly about to take place; yet when a large sum is at stake the relatives have no hesitation in ascribing the death to the slip or fall, and expect the sum named in the policy. Very many such cases have come under my individual attention, and one in particular I remember, in which the subject was an old man dying of senile decay, who was obliged to have a male attendant constantly with him; when death took place there were some marks of bruises, but the medical attendant was very emphatic that death arose solely from natural causes; an interested relative was most anxious for an inquest to be held, in order that a jury might be induced to return a verdict of "Accidental Death" arising from a fall.

Gentlemen, you will readily understand that Accident Insurance is not Life Assurance, and that consequently such cases do

not come within the category of claims to be dealt with under a contract under the former head.

It is impossible, therefore, to issue a policy "free of conditions" or "free of restrictions" unless we are prepared to issue a life assurance on the terms required merely for accident insurance, or are prepared to embark in a vast amount of litigation; it is absolutely necessary to insert in the policy provisions accurately defining the contract. Many persons change their occupation for a more hazardous one, and it is as necessary for the Office to be protected against the increased risk, unless an extra premium be paid, as for a Fire Office to require an additional payment upon the erection of any stove or appliance involving extra risk of fire to the building or contents.

For the benefit of some of my younger friends I may say that the words "assurer" and "insurer" hitherto have been erroneously used as applying to the policyholder. Of course, he is the "assured" or "insured," and it is the Company which is the "assurer" or "insurer."

A paper upon Accident Insurance can hardly be complete without some reference to the corollaries of accident insurance, and the first I will mention is the coupon system. By the means of this a large proportion of the public have come to the conclusion that they need not pay an annual premium for a policy of their own, as they can obtain the security they think is the only one necessary for themselves "free, gratis, and for nothing." They find that if they go to certain theatres, if they buy certain pocket-books, diaries, time tables, braces, cigarettes, or newspapers, they are insured for varying amounts, against varying injuries, and for varying periods of time and under varying conditions. This appears to burlesque Personal Accident Insurance, and the natural conclusion to which people come is that a thing which costs them nothing can be of little value. Give me the man who, if necessary, takes time thoroughly to consider the advantages, the cost, the sacrifices he may have to make to secure the protection of a policy; he it is who is likely to pay his renewal premium within the days of grace, and not require the Office or the agent to spend as much time over him on each renewal as it did to secure his proposal.

The second corollary to which I will refer is the addition of a payment for disablement arising from specified diseases. Pressure of competition has caused various Companies to include varying

lists of diseases, with the result that the "moral hazard" against the Companies is increased enormously; an intending proposer having several prospectuses before him is likely to examine his family history or to ascertain the disease which is the more probable to be epidemic in his locality, and to select the Office which happens to include the particular disease to which he may consider himself more than usually liable. A case in point came under my notice recently; a man subject to carbuncle exchanged his policy at the earliest moment, and promptly made a claim.

That ably conducted periodical, dealing with the profession to which we have the honour to belong, the *Post Magazine*, in a leader on the 11th May, very emphatically drew attention to the growing tendency on the part of the public to assume a liability of the Company for *any* mishap or misfortune, and it fixes the blame on the Companies for having gone outside pure accident insurance and made payments in cases of certain specified diseases; by this means leading people to think, inferentially, that some other disease which they may have had the misfortune to contract should also be paid for. It is much too early to judge whether the inclusion of diseases will profit the Companies, as we cannot tell what will be the effects of a severe epidemic, and therefore out of the extra premium charged to include this benefit a large proportion must be reserved for contingencies. Among the latest novelties is the policy which will carry "accumulations," that is, an annual addition to the sum insured up to a limit of 50 per cent. As experience teaches that the "fatal" claims arise chiefly under policies which have been in existence for some years, this novelty is likely to cost the Company adopting it a very heavy increased percentage under the head of compensation for fatal cases. For this increased cost there appears to be no margin unless the bonus reduction of premium, or some other benefit, be discontinued.

Another novelty is the annuity provided for a beneficiary who is to be named. I cannot see that this can be on an actuarial basis, as it is impossible to forecast what will be the age of the beneficiary at the date of a fatal accident to the policyholder, a difference of age of, say, 20 years involving a sum of over £200. I note, however, that in one instance at least the annuity is limited to 10 years; even then the additional charge is likely to be very considerable.

Another, is to increase the sum insured at death provided no

pay be taken for the first fortnight of disablement. This appears likely to benefit the very few at the expense of the many.

After what I have said as to the special character of Personal Accident Insurance you will not be surprised that one of our large Life and Fire Insurance Companies, after a few years' experience, gave up attempting to carry on accident business, and that the Chairman of the Company, in announcing the decision of the Directors to the shareholders, said: "We have discovered by experience, not only that we were too late in the field, but that the character of the business required a special and different organisation and class of agents to ours to work it properly."

One of the great difficulties in dealing with accident claims is sometimes met with in the want of *bona fides* of the medical attendant. Three cases occur to me. One was that of a man very much over-insured, who alleged that he slipped on the kerb and injured his back; he was soon certified to be paralysed in all his limbs, to be suffering from spinal injury, and as unlikely ever to recover. A few days later, on calling at the house, I found him in bed, apparently absolutely helpless, almost panting for breath; I saw his clothes in an untidy heap under the bed, and immediately recognised him as a man who had reached the house a moment after I had knocked, and who passed in before me on the door being opened. Shortly afterwards, when passing, I noticed that the house was empty. Another case was certified as fracture of certain bones, and when these could no longer be hidden by bandages, a back injury was alleged; circumstances pointed to a deliberate conspiracy to defraud, and the man got nothing for his trouble. Another case: I found a man certified as so and so suffering total disablement and also, for the purposes of a claim upon another society, certified by some other name by the same medical attendant, who stated that his patient required change of air. I ascertained that the bailiffs had turned him into the street for non-payment of rent.

I suppose it has not yet fallen to your lot to be sued for the expenses of your own burial. This is not an accident case, but it was related to me in this city as one that has actually occurred in one of our Colonies. A dead body was recovered from the harbour and identified by a married woman as that of her husband. She gave directions for the funeral, which was duly performed. Shortly afterwards her husband returned from "up country," and was astonished to find that he was summoned to pay the account which his wife had incurred.

A colleague of mine on one occasion saw a man in a coast town across the water pretending to be suffering from a serious injury; shortly afterwards on visiting a case in one of our ports he found the same man under another name living expensively in a hotel, and assuring the landlord that money was coming from an Insurance Company for an accident from which he alleged he was then suffering. As he did not recover the compensation he anticipated, I doubt whether the landlord was ever paid for the board and lodging.

You will agree that if a person pays the proper premium for an insurance, and the contingency happens against which he has sought to guard, he is entitled to the compensation contracted for, and to be even liberally dealt with, and I am not one for endeavouring to drive a bargain with him; but from what I have said you will see that this class of business requires great shrewdness and tact and careful watching to prevent imposition.

I thank someone who recently wrote that Accident Insurance Companies are looked upon as beneficent agencies doing an immense amount of good, not institutions to be plundered, and I sincerely hope that for long years to come the public will find that it is possible to secure the benefits at a cost which after all is extremely moderate.

As all the Companies which transact Personal Accident Insurance now undertake to indemnify employers against the liability arising from accidents to their workmen, I feel that you wish me to say a few words on the subject. You are aware that prior to 1881, a workman could recover compensation from his employer only in the rare cases in which he could prove personal negligence on the part of the latter, and how in that year an Act came into force giving him the right to recover in cases where he could prove that his injury arose in consequence of defective plant, or because of negligence on the part of anyone having superintendence over him; his rights, however, were so restricted by conditions of a most technical character that an immense amount of litigation followed, and after all only a comparatively few workmen or their families benefited. Then came a long struggle to obtain compensation for all accidents arising in the course of employment, and, mainly owing to the strenuous exertions of your talented and far-seeing member, in 1897 the Workmen's Compensation for Accidents Bill, after very much discussion, passed into law. It was described as the Magna Charta of the working

man, and constant statements were made that under its provisions litigation would be avoided. What a commentary upon those statements that after three years' working of the Act there were in the Court of Appeal last month 52 cases to be heard in which the parties interested were appealing against the decisions given by County Court Judges or Arbitrators, and one of the Judges of Appeal was constrained to inform the Court that "it must be distinctly understood that the Act was intended for the benefit of the working man, and not for the benefit of the legal profession"!

But I am anticipating.

Upon the third reading of the Bill in the House of Commons, on the 15th July, 1897, Mr. Chamberlain said:—

"The principle is that every workman in the trades specified in this measure will, in future, be entitled of right to moderate and reasonable compensation for *all* the accidents which may happen to him in the course of the business in which he is engaged, unless those accidents are caused by his own gross and wilful default."

The Government accepted, and became responsible for that principle, and when the Bill was in the Upper House Lord Salisbury took the trouble to explain that a charge upon the employer, and through him on the consumer, is less Socialistic than a charge upon the ratepayer.

What more natural, then, than that the Insurance officials who were studying the measure and endeavouring to assess the terms upon which an indemnity against this liability could be granted to employers should have considered that, in the interpretation of the Act by lawyers and the Judges, the spirit of the Act would be followed, rather than the strict letter? Well, you know what followed. Rates were framed, and although their moderation was beyond question, yet the employers became panic-stricken at the thought that their expenses were to be increased by a matter of from £5 upwards on £1000 of wages. All sorts of means were sought to rid themselves of this cost which they considered so burdensome and even ruinous.

References were made to the confident statements of the members of Parliament who were responsible for the Act that the cost would not exceed 5s. per cent. on the wages in most trades, and unfortunately some Insurance Companies offered to accept the liability at rates which were thought to be inadequate even by

the employers themselves. The result was that several other Companies lowered the terms, and there was an undignified scramble for a business which, after all, was of a highly speculative character, inasmuch as there were no data upon which anyone could assess the payments which would have to be made to dependants and partial dependants of a deceased workman, or assess the capitalised value of the weekly payments to be awarded for mutilation or permanent injury.

Well may those Insurance officials who had the courage of their opinions now feel thankful that they were not led away by the somewhat inconsistent speeches of the eminent member for West Birmingham!

Inconsistent, I say, because Mr. Chamberlain, in a speech at Manchester, on the 15th November 1898, respecting the Workmen's Compensation Act, said:—

"That is an Act which has established for the first time the principle that when a man is injured in the ordinary course of his employment, without wilful misconduct on his own part, he is entitled to charge the compensation for that injury as a liability upon the business in which it took place. I do not think that anyone will deny that the establishment of that principle is an *enormous boon* to the working classes of this country," and yet he went on to say that "for the vast majority of trades 5s. is the outside charge on the wages," and when he was interrupted by someone saying "No," he reiterated "I say for the vast majority of trades 5s. per cent. on the wages is *outside* the actual cost of the working of this Act."

Well, if 5s. per cent. is more than the cost, where is the "enormous boon"? Think for a moment what this view of the cost means. It means that if a man be earning £1 a week, this Compensation Act has given him, on an average all round, 2s. 6d. a year, or say £5 during his life, assuming a period of work of forty years. This, please to recollect, is "outside the actual cost" for the "vast majority of trades"; the cost in ordinary weaving or spinning establishments, it was said, would be 1s. up to 2s. per cent., that is, 6d. a year, or £1 during life, on the above basis. That certainly cannot be described as an "enormous boon" or as a Magna Charta.

I have taken Mr. Chamberlain on his own estimate of the cost, but you gentlemen of experience full well know that to arrange for payments even on this scale involves an expenditure for

administration, correspondence, and book-keeping which must be added to compensation. Mr. Chamberlain, in the above-mentioned speech, went on to say: "My advice to every manufacturer who is not engaged in an exceptionally dangerous trade, like coal mining, is either to take the risk themselves or to join with others in the same trade in a mutual insurance."

In my humble way, in a letter to the *Times* and other newspapers on the 17th November, 1898, I ventured to warn manufacturers who acted upon this advice that they would find the cost would "be a quarter per cent. multiplied many times," as I had noticed that the reported accidents in "factories" alone had increased during the four months the Act had been in force to the large extent of 58·9 per cent. over the corresponding period of the previous year.

Since that date we have accumulated three years' experience, and I have no reason to modify the views I then held, for I see by the returns that the numbers of accidents in factories are reported as:—

In 1897	40,474
„ 1898	57,562
„ 1899	70,760
„ 1900	79,020

These figures apply only to a portion of the industries brought within the Act.

I am willing to allow that there has been an increase of trade, but I do not admit that that increase is nearly 100 per cent., or that the workmen have increased in numbers by 100 per cent.; indeed, the Home Office returns show an increase of only 4·9 per cent. in the numbers employed in factories. What, then, is the explanation? It is not far to seek.

We now know that many deaths are attributed to accident which in the old days would have been registered as resulting from disease, and that many men, advancing in years, on receiving a more or less severe injury, make it a basis for securing a retiring allowance or pension, and so being enabled to live at their ease, instead of performing laborious work and subsequently living on the charity of their relations or friends, or going into the workhouse infirmary.

Mr. Chamberlain said that he and the then Home Secretary had lists of the different occupations, and that they had made

estimates of the cost of the Act based upon the experience of "several preceding years."

How many Insurance officials and employers are now rueing the day they accepted the assertions of the Colonial Secretary can never be known; but could a more fallacious basis be devised?

To mention only a few cases in illustration.

A workman received an injury when at work and subsequently suffered from lung mischief, and 20 months from the date of the injury died, his death being attributed to the injury.

A workman died from bronchitis, from which he had been suffering for some time; but as, shortly before death, he received an injury, the employer was asked for the capital sum named in the Act.

A workman's hand was jarred, and subsequently he suffered from an attack of gout. The judge held that the employer had accepted the workman with all his infirmities and must pay. This was upheld upon appeal. Lord Justice Collins said: "The extent of the injury must depend upon the condition or constitution of the person at the time of the accident."

I ask, would such cases have been recorded in years preceding the Act, and so have assisted in forming the basis upon which the cost was estimated? The answer is emphatically, No!

Again, in the case of mutilations, which, I may say, involve the employers in a heavier liability than do the deaths of workmen, how can there have been a basis upon which the capitalised value of the weekly payments could even be guessed? Experience shows that when a man, owing to a mutilation, of however slight a character, obtains a weekly allowance, he is slow to earn as much as he did before the accident, and consequently the liability for the weekly payment remains with the employer or his Insurance Company.

One of the County Court Judges has said that he cannot force a man against his will to return to the employment in which he has suffered a serious accident.

To illustrate my meaning I will mention two cases—

A workman aged 30 in receipt of £2 a week suffers an amputation of a limb, is entitled to £1 a week, and when he has recovered, as far as ever he can recover, obtains work at £1 a week or less; the employer, in whose service he sustained his injury, still remains liable for £1 a week, and the Insurance Company who have indemnified him should charge, against the

premium for the year in which the accident occurred, the capitalised value of this sum, which, according to the Government tables, is £1063 12s. 4d., or £779 15s. 8d. if the workman's age were 50. Fortunately, by the tables of Insurance Companies the cost would not be quite so large.

Another case. A lad aged 20 in receipt of £1 a week suffers the mutilation of a part of a hand, and therefore for a period is entitled to 10s. a week; but when the wound is healed he declines to work, the cost of going to the court from time to time to obtain a revision and diminution of the weekly allowance will soon mount up to large figures, and the probability is that you cannot entirely rid yourself of the liability to pay something except by commuting, and this, also according to the Government tables, may cost £592 11s. 8d.

In the case of a female the liability is greater.

The Insurance Companies who have transacted this class of business in any bulk are getting on to their registers the names of annuitants who may require their payments for thirty, forty, even fifty years to come, even though the particular business in which they received their injuries has long ceased to exist. You are aware that, by the rules, the Courts have taken care to have the necessary machinery for securing the weekly payments for the workman direct from the Insurance Companies in the event of the bankruptcy of the employer.

As each premium received by the Companies will bring its own contingent liabilities, you must not look to future premiums to provide the funds for accidents now arising. To avoid a catastrophe in the future it is essential to have an annual valuation of the outstanding liabilities, to see that a sufficient reserve has been set aside to meet them.

You would have thought that an Act of Parliament which was to be the "Magna Charta" of the working man, and was to avoid litigation, would have been as simple as possible in its terms, so that he who runs might be able not only to read it but to understand it; but after three years' and more experience of it what do we find? As I said above, 52 cases in the Court of Appeal, and the law altering almost daily! How, then, is an estimate to be framed of the probable cost in any particular occupation?

Take a few cases only.

A coal merchant has a wharf, and at some distance in a river his steamships are discharging across a stage into barges. It may

be you quote a low rate, because you consider that only the workmen engaged on the wharf can recover under the Workmen's Compensation Act: the rest, you think, have a remedy only under the common law and Employers' Liability Act, 1880. Suddenly the High Court decides that the stage in the river is a "factory," and as you have contracted to indemnify the employer against his liabilities you have to pay, under the low rate, sums to secure which you ought to have charged five or six times the rate; further, you have the unexpected liability for the remainder of the period of insurance.

It has taken more than three years to secure an authoritative decision as to the measurement to be adopted for buildings. We are now informed that we must measure from the top of the footings, and that each building must be judged by its merits; but we do not know that the House of Lords may not decide that we are to measure from the bottom of the footings, or include the layer of concrete under the footings.

So far, nearly all the cases which have gone from the Court of Appeal to the House of Lords have been decided by the latter body in a manner favourable to the workmen, thus reversing the decisions of the Court below and extending the Act immeasurably.

I could give you numberless similar instances, but I will not weary you. It is clear, I think, that, even with the experience which has been gathered, this class of business remains of a highly speculative character, and that there are breakers ahead.

To avert disaster, employers and Insurance Companies should urge the Government to require all associations and persons who have underwritten the liability to file annually with the Board of Trade an actuarial valuation of the outstanding liabilities and a statement of assets to meet them. This was ably shown to be necessary by Mr. Linnell of the Sun Life Office, in a letter to the *Times* dated 25th April, 1898.

While I am not in agreement with Mr. Chamberlain in his estimates of the cost of the Act, I am in entire agreement with him in his statement that by the passing of the Act the workmen have an "enormous boon." Indeed they have a boon that at present is unfathomable; and it may be that the ratepayers of the dim and distant future may find that their poor rate is slightly reduced; but as clear as daylight is it that now an entry has justly been made upon the path of recognising the right of the unfortunate among the "industrial army" to compensation for

injury received during employment, there is no turning back, and gradually, imperceptibly almost, more trades, larger bodies of workmen, will be brought within the beneficent conditions allowed by law.

The more one studies the phrasing of the Act, the methods of workmen in regard to it, and the decisions of the Judges, the more one feels the necessity for caution in assuming the liability.

Time fails me, gentlemen, even to touch upon the other departments of Employers' Liability, such as common law and third-party risks in respect of accidents to the public, and the many other branches of business now undertaken by some of the Companies which transact Personal Accident Insurance.

I thank you for the very patient manner in which you have been kind enough to listen to me.

It has been a great satisfaction to me to have had the opportunity of addressing you, and if any thoughts of mine lead to the raising of this class of business from a speculative to a sound basis, or the warning of any Company to steer clear of the breakers ahead, I shall feel that I have not spoken in vain.

> We men, who, in our morn of youth, defied
> The elements, must vanish ;—be it so !
> Enough, if something from our hands have power
> To live, and act, and serve the future hour.

ALFRED FOOT, F.S.S.

Birmingham Insurance Institute,
December 6, 1901.

INDUSTRIAL LIFE ASSURANCE.

THE great love of independence and the dread of pauperism among the English working classes is manifested in no more striking manner than by their own persistent efforts to make provision for the extra expense occasioned by sickness and death. These early efforts to obtain some form of provident insurance were peculiar to the English-speaking people; it was their own invention, and arose from what they themselves felt to be an absolute necessity. Recognising this truly fine national characteristic, it is pitiable to recall the many difficulties which were met with before the eventful evolution of a reliable and equitable form of Industrial Assurance.

In endeavouring to trace the history of Industrial Assurance we find that, although Burial Clubs and Friendly Societies in various forms have existed for many years, yet Industrial Insurance, as we now know it, is a matter of quite recent history, and its tremendously rapid growth would certainly seem to show that what was for so many years persistently sought after by the English people has at length been attained. We find, by reference to the Charters of the Guilds, which existed in the middle ages, that provision was made for the burial of the dead as one of the most important duties to be discharged by members of the association to one another. In the reign of Henry VIII. the property of these Guilds was confiscated, and their place was eventually taken by various Burial Clubs and Friendly Societies, in which little or no attempt was made to fix the amount of premium to be paid so that it should be an equivalent of the benefit to be received. Uniform premiums for all ages at entry were most usual, and consequently it generally happened that as members grew old younger men did not care to join, and bankruptcy often resulted. Of course there was no such thing as an actuarial valuation, for even if such had been thought necessary there was no actuarial knowledge available for the purpose, and if a Society *did* happen to accumulate what was considered a large fund, the benefits were generally increased and feasting of the members

was freely indulged in. Towards the end of the eighteenth century various attempts were made at Government supervision, and undoubtedly the several Acts passed during the nineteenth century have had a most salutary effect in exposing the unsound financial position of many Societies and inducing them to take the necessary steps to place their business on a safer basis, but even at the present time it is notorious that there are many of the smaller Friendly Societies whose financial position is anything but satisfactory.

The first Industrial Life Assurance Company was founded in 1849 under the title of the Industrial and General, and is thus referred to by the *Liverpool Chronicle* of that date:—"We have had our attention directed to a brochure bearing the title 'What is Life Insurance?' written by the Rev. J. B. Beade. It is in the form of a dialogue between two labouring men, and is mainly calculated to show the illiterate and unthinking the great advantages offered by well regulated and stable assurance associations. The Industrial and General Life Insurance and Deposit Company has been instituted and arranged on a plan expressly to meet the requirements of persons of limited incomes accruing at short periods. With a view of adapting it to the wants and wishes of the industrial classes, the directors have arranged to grant assurances and annuities as low as £5, at premiums payable weekly, monthly, quarterly, or annually." In 1852 an offshoot of the above Company—namely, The British Industry Life Assurance Company—was founded, and contained in its prospectus the following advertisement:—"Adapted to meet the requirements of the middle and industrial classes by granting policies as low as £5 or under that amount according to age; by accepting premiums in weekly, monthly, quarterly, half-yearly, and annual payments; by protecting the assurers when circumstances arise to interfere with their regular payments; and other decided advantages unattainable by the rules of general assurance offices. . . .

"Clothing life assurance in the humblest possible habiliments, disguising its virtues under the most retreating form that ingenuity could invent, it would be difficult to prevent the most unpractised eye from discovering the presence of a true friend; indeed, a guardian angel whose ministering objects cannot but be considered little less than divine. . . .

"An inspection of the following table will show that the interests of all classes have been consulted in their formation, and

that the poor man may follow the dictates of affection and duty by using the road now thrown open to his use. It is to be hoped he will not neglect or delay embracing the means thus afforded him of showing to a discerning public, that the coarser cloth does not always cover the coarsest heart, and that the poor man's affection for his offspring issues from as pure a source, and flows as determinedly along, as may that of the generality of those who are termed the better classes."

But notwithstanding this high-toned announcement we find that the "poor man's" premiums were mostly wasted in exorbitant salaries to incompetent officials. In 1853 there was a tea meeting at the Town Hall of Birmingham at which some "nasty" things appear to have been said. Subsequently there was a change of management and the business was put upon a sound footing.

In 1854 the directors of an ordinary Assurance Company, after having made many enquiries and careful investigations, decided to commence the transaction of Industrial business. They recognised from the first the great difficulty of deciding upon a scale of premiums which should be equitable from the assured's point of view as well as sufficient to ensure the security of the contract. The actuaries of the day had practically no experience of Industrial Assurance or data upon which to base reliable tables of premiums. Very little help could be obtained from existing Societies (Burial Clubs, &c.), as it was well known that their financial position was very far from satisfactory, and moreover it was usual in those Societies to charge the same premium for widely differing ages at entry. The tables finally decided upon were eight in number, six of which were so calculated as to allow the policyholder to withdraw one-half of the premiums paid in after two years had elapsed. The youngest age to be assured was 10 and the oldest 60. The following is a specimen of the first table issued:—

	Age.	Sum Assured. £	s.	d.
Weekly Premium 1d.	10	11	9	0
	15	9	16	0
	20	8	11	0
	25	7	7	0
	30	6	6	0
	35	5	7	0
	40	4	11	0
	45	3	16	0
	50	3	3	0

"Full Benefit" was granted in all tables from the date of entry. It was eventually found that the business could not be maintained unless younger ages were admitted, and the minimum was therefore reduced to 7; it was also found impossible to continue those tables which permitted of the premiums being withdrawn. It was not until some time later that the Company decided to issue policies on the lives of infants, and even then it was thought advisable to introduce the table into a few districts only, but the results proving satisfactory, the system was gradually introduced into other districts. The following is a copy of the first table issued:—

TABLE OF SUMS PAYABLE FOR ONE PENNY WEEKLY.

Age of Child at Entry.	Amount payable if Child should die after the Policy has been issued.						
	Three Months.	1 Year.	2 Years.	3 Years.	4 Years.	5 Years.	6 Years.
	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.
Not less than 3 months, and not exceeding 6 months	0 10	1 0	2 0	2 10	3 0	3 10	4 0
1 Year next birthday ..	0 10	1 0	2 0	2 10	3 0	3 10	4 0
2 Years ,, ,, ...	0 15	1 5	2 5	2 15	3 5	3 15	4 5
3 Years ,, ,, ...	0 15	1 5	2 5	2 15	3 5	3 15	4 5
4 Years ,, ,, ...	0 15	1 5	2 5	2 15	3 5	3 15	4 5
5 Years ,, ,, ...	2 10	3 5	4 10	5 10	6 10	7 0	8 0
6 Years ,, ,, ...	3 0	4 0	5 5	6 5	7 0	7 15	8 10
7 Years ,, ,, ...	4 0	5 0	6 0	6 15	7 10	8 5	9 0
8 Years ,, ,, ...	4 15	5 15	6 10	7 5	8 0	8 15	9 10
9 Years ,, ,, ...	5 10	6 5	7 0	7 15	8 10	9 5	10 0

If the Child should die within Three months from the date of the Policy no sum will be payable.

The table was shortly afterwards replaced by the following:—

TABLE OF SUMS PAYABLE FOR ONE PENNY WEEKLY. (NO HIGHER PREMIUM CAN BE TAKEN.)

Age at Entry.	Amount payable if the Child should die after the Policy has been issued for										
	Three Calendar Mths.	One Year.	Two Years	Three Years	Four Years	Five Years	Six Years	Seven Years	Eight Years	Nine Years	Ten Years
	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.	£ s.
1 Year next birthday	1 10	2 0	2 10	3 0	3 15	4 10	5 15	6 15	7 15	9 15	10 0
2 Years ,,	1 10	2 0	2 15	3 5	4 5	5 10	6 10	7 10	9 10	10 0	
3 Years ,,	1 10	2 0	3 0	4 0	5 5	6 5	7 5	9 5	10 0		
4 Years ,,	1 15	2 15	3 15	5 0	6 0	7 0	9 0	10 0			
5 Years ,,	2 10	3 10	4 15	5 10	6 10	8 15	10 0				
6 Years ,,	3 0	4 10	5 5	6 5	8 10	10 0					
7 Years ,,	4 0	5 0	6 0	8 5	10 0						
8 Years ,,	4 15	5 15	8 0	10 0							
9 Years ,,	5 10	7 15	10 0								
10 Years ,,	7 10	10 0									

If the Child should die within Three calendar months from date of Policy no amount will be payable.

Some of the early difficulties attending Industrial Assurances have already been referred to, but there were many others. To arrange to collect a number of premiums in one district is a fairly simple matter, but it is quite another matter to provide for the policyholder who suddenly removes to some remote rural district and still expects to have someone call upon him regularly every Saturday night to collect a few pennies. The difficulty of building up a great system of agencies was still further increased by the ill-fame of the class of men who had formerly been employed by the Burial Clubs (or dead briefs as they were sometimes called) and kindred Societies. These men were often those who had failed to procure an honest living at other callings, and it certainly cannot be said that they succeeded (so far as honesty is concerned) when acting as collectors. The temptations and difficulties met with by insurance agents are very many, and it is therefore highly essential that they should be in all cases men of some considerable business ability as well as of the highest moral character. The difficulty of their task in the past was considerably increased owing to the unenviable reputation earned for them by their predecessors, but it is a matter for the sincerest congratulation that, notwithstanding the old adage concerning a dog and a bad name, assurance agents of the present day are rapidly outgrowing, if indeed they have not already outgrown, their past reputation, and the mere fact of a man being a valued servant of any large and respected Insurance Company should be a sufficient guarantee that he is also a business-like and honourable man.

In 1864 a Bill was introduced in Parliament with the object of enabling the Government to transact the business of assurance. This Bill was strongly opposed by a large Company and a Burial Society. The Chancellor of the Exchequer (Mr. Gladstone) during the discussion on the Bill made certain speeches in which the solvency of the Insurance Company was made to appear extremely doubtful.

It is needless to say that a statement of this kind made by so high an authority might have been expected to have most prejudicial effects by creating a bad opinion in the minds of those who had no technical knowledge of assurance matters, but the result was exactly the opposite. The absolute solvency of the Company was amply proved, and Mr. Gladstone, in a subsequent speech, considerably toned down his previous statements. The attention of

many people was thus directed to Industrial Assurance who probably would not otherwise have heard of it, and from that time the business of Industrial Assurance has grown in a manner which then would have seemed impossible. The Bill above referred to was duly passed, and from that time the Government has been a competitor for Industrial Assurance business, but it has met with singularly little success. Big Companies have, however, risen up and succeeded in obtaining enormous numbers of policies, until we find by the end of 1900 that 14 Companies are able to report a total number of 18,653,846 Industrial policies in force, insuring a net amount of £181,135,538.

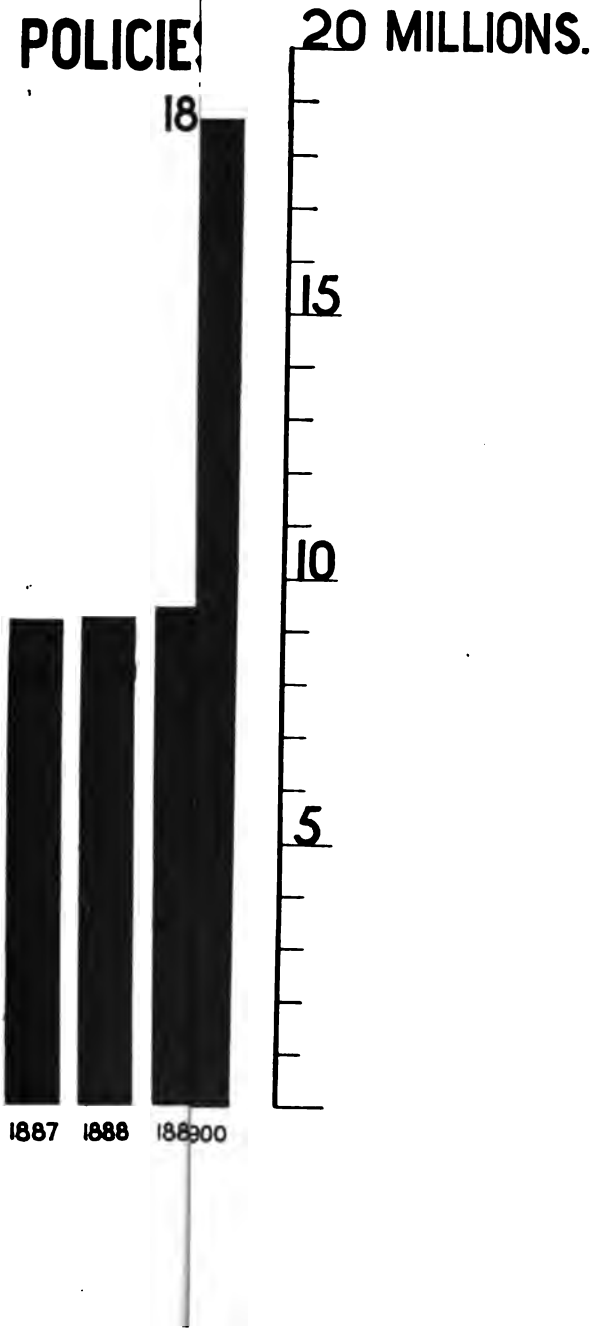
In order to give some idea of the remarkable growth cf Industrial Assurance during recent years I have taken some figures from the Board of Trade Returns and drawn diagrams to represent them. Thus in the first diagram I represent the number of Industrial policies in force from 1887 to 1900, the actual figures being as follows:—

Year.	Policies.	Year.	Policies.
1887	9,145,844	1894	13,324,778
1888	9,208,671	1895	14,990,581
1889	9,412,991	1896	15,301,621
1890	9,432,778	1897	15,860,654
1891	9,879,928	1898	17,230,712
1892	12,834,142	1899	17,857,134
1893	13,213,554	1900	18,653,846

In the next diagram I show the total amount insured for the years 1887 to 1900. The figures are as follows:—

Year.	£.	Year.	£.
1887	83,434,487	1894	128,064,110
1888	83,891,620	1895	144,142,569
1889	85,920,639	1896	147,189,925
1890	86,203,873	1897	152,075,807
1891	90,983,761	1898	165,990,481
1892	122,760,631	1899	172,649,457
1893	126,797,704	1900	181,135,538

In the third diagram I show the total assets for 20 years, viz., from 1881 to 1900. It will be noticed that during these 20 years the amount has increased in the ratio of nearly 14 to 1. It will also be noticed by comparing Diagrams 2 and 3 that in 1887 the assets of the Companies represented £6 13s. 2d. per cent. of the sums assured, whereas in 1900 it represented £11


POLICIES
20 MILLIONS.
18
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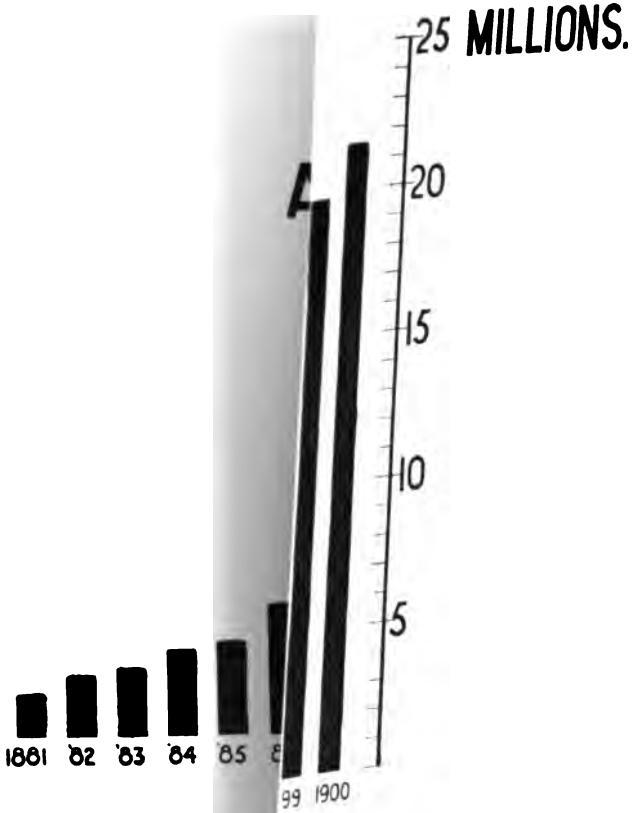
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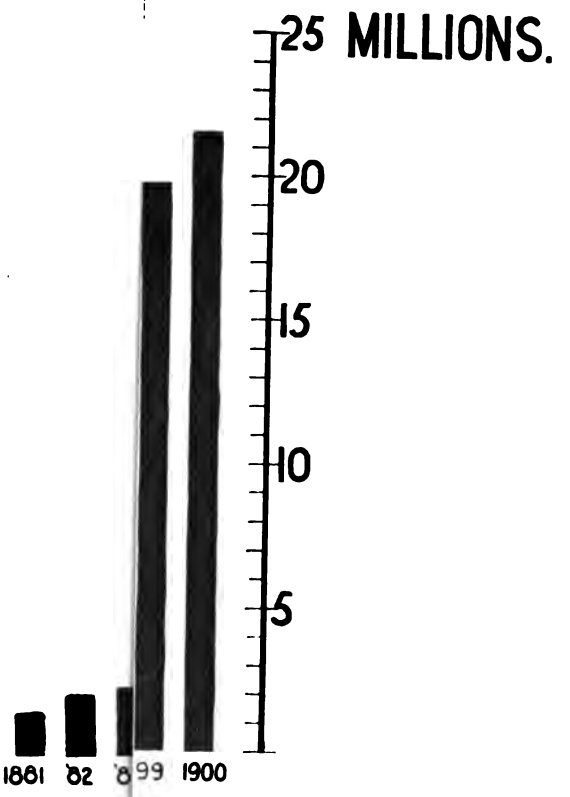
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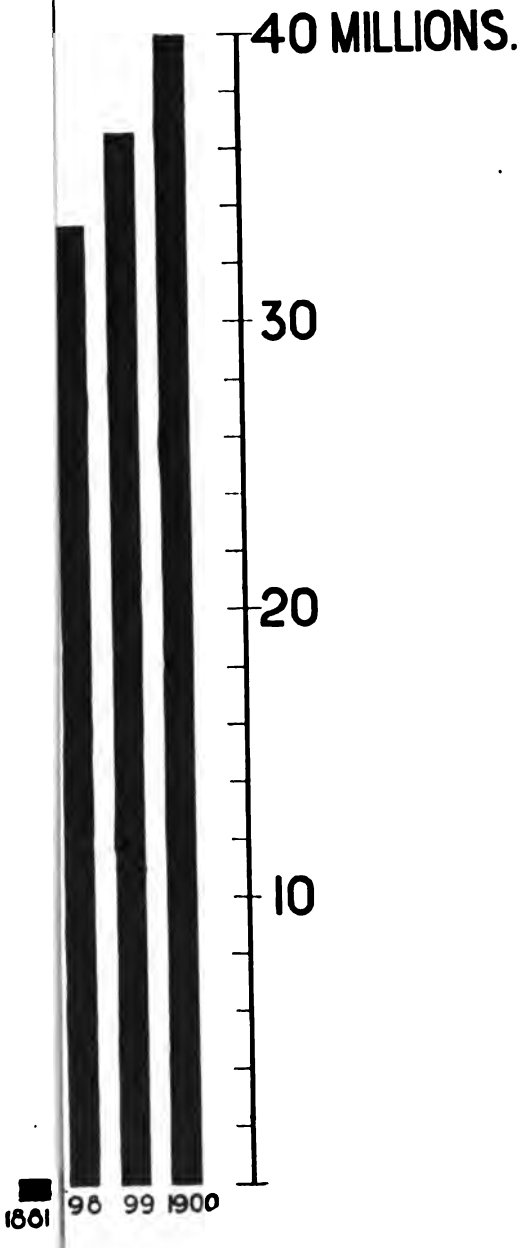

40 MILLIONS.
30
20
10
1861
96
99
1900

17s. 6d. per cent., or nearly double the percentage of 1887. The actual figures are as follows:—

Year.	£.	Year.	£.
1881 ..	1,588,915	1891 ..	9,662,026
1882 ..	2,060,856	1892 ..	10,771,689
1883 ..	2,411,754	1893 ..	11,385,953
1884 ..	3,065,285	1894 ..	12,439,285
1885 ..	3,834,709	1895 ..	13,803,227
1886 ..	4,667,916	1896 ..	15,003,789
1887 ..	5,566,131	1897 ..	16,511,278
1888 ..	6,248,513	1898 ..	18,157,993
1889 ..	7,187,076	1899 ..	19,775,676
1890 ..	8,737,936	1900 ..	21,512,384

It will be noticed that in all three diagrams there is a sudden increase at the end of five years and also at the end of periods of three years; this is owing to the figures being those given in the Board of Trade Returns, which are taken from the periodical valuation returns.

The last diagram represents the amounts paid in claims. Thus the first column represents £697,778, which was the amount paid in 1881. The second column represents £697,778 + £779,985, being the claims paid for the two years 1881 and 1882. The last column represents £39,939,193, being the total amount paid in claims during 20 years. The actual figures for each year are as follows:—

Year.	Claims.	Year.	Claims.
1881 ..	£697,778	1891 ..	£2,184,851
1882 ..	779,985	1892 ..	2,537,261
1883 ..	957,350	1893 ..	2,451,965
1884 ..	1,124,622	1894 ..	2,547,832
1885 ..	1,250,250	1895 ..	2,418,754
1886 ..	1,366,537	1896 ..	2,774,101
1887 ..	1,461,832	1897 ..	2,751,230
1888 ..	1,588,174	1898 ..	2,912,046
1889 ..	1,663,661	1899 ..	3,131,916
1890 ..	1,928,406	1900 ..	3,410,642

The number of Industrial Assurance Companies in the United Kingdom during the 20 years 1881 to 1900 has been as follows:—

1881	..	11	1891	..	12
1882	..	12	1892	..	12
1883	..	13	1893	..	11
1884	..	10	1894	..	11
1885	..	9	1895	..	11
1886	..	9	1896	..	11
1887	..	12	1897	..	11
1888	..	13	1898	..	11
1889	..	11	1899	..	14
1890	..	13	1900	..	14

I may point out that the reason why the first two diagrams only include 14 years, instead of 20 as the last two diagrams do, is that the Board of Trade Returns are not in the requisite form for obtaining the necessary data.

Some of you gentlemen who are present to-night could, I expect, recount many interesting histories of the way in which part of this enormous business was obtained. Industrial canvassing was not always carried on under the same conditions as at present; there may be some here who can remember a certain gentleman who, instead of going round from house to house, used once every week to sit at a table in the open air and register the names of a crowd of intending insurers. Sometimes, whilst still surrounded by anxious customers, he would suddenly close his book and call out "Full up for this week, can't take any more." He himself used to declare that the idea of possibly being too late induced many to come the following week who otherwise would not have done so.

Although the figures represented in the diagram show an enormous rate of increase in Industrial Assurance, they do not, I think, represent the true progress, since a very large amount of the ordinary policies in force would never have existed had it not been for the introduction afforded by the Industrial policy. An Industrial policy for a small amount is taken out, and subsequently the amount assured is increased, then probably it is pointed out by the agent that for a very slightly increased amount per week the sum assured could be increased to £50 by taking out an ordinary policy on which the premiums could be paid quarterly. Very probably the ordinary assurance is increased after some years, and in this way there is a steady march forward. Industrial assurance is an education, and is undoubtedly the direct origin of much of the ordinary assurance. It is quite possible that the rate of increase in the total amount of Industrial assurance will

not in the future be anything like what it has been in the past, but we may safely predict that the small ordinary assurance policy will become more and more popular.

In considering the enormous progress of industrial assurance during the past 20 years it is necessary to notice other features besides the gigantic increase in the number of policies. One of the most important of these features is the increased security afforded to the Industrial policyholder. We have already referred to the very unsatisfactory financial state of the various Burial Clubs, &c., at the time Industrial Assurance was first started. From the very commencement the greatest care was exercised by those Industrial Assurance Companies which are now in existence in order to make the fulfilment of the contract as certain as possible, but it was for many years impossible to offer that absolute security which the large Industrial Companies are now proud to be able to point to. The working man pays his small weekly premium and is able to rest on the absolute certainty that the sum assured will be paid. The directors of large Industrial Assurance Companies, recognising the necessity for absolute safety, will not be tempted by any high rate of interest; the desirability of unchallengeable security is always foremost in their mind, and hence we find millions and millions of Industrial funds invested only in the highest class trustee securities, although by doing so they (the directors) reject larger profits and lay themselves open to much adverse criticism for what, by some, are considered unnecessary precautions. I think, however, that Englishmen should be proud of the position of Industrial Companies to-day; they are monuments of the people's own unselfish forethought and love of independence; the funds are a great trust which must under all circumstances be strictly guarded and tended, in order that the amounts stated in millions of Industrial policies may be paid immediately they become due.

In the early days of Industrial Assurance it was found advisable to charge higher premiums for various occupations, such as miners and sailors, but for many years past it has been the practice of large Companies to charge one general scale of premiums, thus avoiding a restriction which was always somewhat vexatious. It is of course evident that a concession of this kind is only possible when the number of policies in force is sufficiently large to include a fair proportion of all classes of the population. Another example of a valuable concession which has recently been made to policy-

holders is the dispensing with extra premiums for the risk involved by our soldiers and volunteers in South Africa. It would be difficult to measure the actual loss thus incurred by the Companies, but it may safely be said that it is very much greater than is generally supposed.

Mr. Eady, in a valuable and interesting paper read before the Insurance Institute of Victoria and Melbourne in June last, gives some figures showing the astonishing growth of Industrial Assurance in the United States, thus:—

Year.	Number of Companies.	Number of Policies.	Amount of Assurance in force.
			£
1876	1	2,500	48,668
1881	3	359,942	6,528,359
1886	3	1,764,158	39,338,975
1891	9	4,302,427	96,212,143
1896	11	7,375,688	177,296,974
1899	14	10,048,943	258,551,208

It will be noticed that the average sum assured is £26, as compared with about £10 in Great Britain. The very much larger average sum assured in the United States is probably owing to the different scale of infantile assurance allowed by statute, and also to some extent to the difference in the classes of assurance which are popular in the two countries.

The maximum amount of assurance on the lives of infants in Great Britain, as allowed under the provisions of the Friendly Societies Act, is, as you know, £6 up to age 5, and £10 for ages between 5 and 10, and even these amounts are higher than those adopted by Assurance Companies, whereas the legal maximum allowed in most of the States is as follows :—

Between ages		1	and	2	years	30	dollars
,,	,,	2	,,	3	,,	34	,,
,,	,,	3	,,	4	,,	40	,,
,,	,,	4	,,	5	,,	48	,,
,,	,,	5	,,	6	,,	58	,,
,,	,,	6	,,	7	,,	140	,,
,,	,,	7	,,	8	,,	168	,,
,,	,,	8	,,	9	,,	200	,,
,,	,,	9	,,	10	,,	240	,,
,,	,,	10	,,	11	,,	300	,,
,,	,,	11	,,	12	,,	380	,,
,,	,,	12	,,	13	,,	460	,,
,,	,,	13	,,	16	,,	520	,,
,,	,,	16	,,	17	,,	612	,,
,,	,,	17	,,	18	,,	700	,,
,,	,,	18	,,	19	,,	784	,,
,,	,,	19	,,	20	,,	855	,,
,,	,,	20	,,	21	,,	930	,,

Mr. Eady also points out that Industrial Assurance is practically unknown outside the British Empire and the United States. The following table is given as showing the comparative amount in the different countries:—

	No. of Policies.	Amount of Assurance.
United Kingdom ..	18,653,846 ..	£181,135,538
United States ..	10,048,943 ..	£258,551,208
Australasia	241,000 ..	£5,200,000

In the past there have been many objections raised to infantile assurance on the ground of its being conducive to neglect or even worse, for the purpose of obtaining the assurance money. Without entering into any lengthy argument on the subject, I would like to point out some of the many ways in which the life of the child is safeguarded.

1. The amount of assurance allowed by statute is so small that it is barely sufficient to meet the expenses of burial, &c. 2. More than one assurance on the same life is impossible, owing to the regulation respecting the Registrar's Certificate of Death, viz., that no claim shall be paid without the production of the Registrar's Certificate, stating the amount to be received, and whether it is the first or second certificate issued. By this means it is made impossible to exceed the statutory limit. 3. The leading Assurance Companies will not accept any proposal on the life of an illegitimate child until at least three years of age. 4. In the case of death of any child in which an inquest is held, the first

question usually asked is whether any assurance has been effected. It is obvious that the mere fact of there being an assurance would cause a closer enquiry to be made than would otherwise be deemed necessary. I think if these points are properly considered the weakness of the arguments of opponents to infantile assurance will be evident.

In 1890 a Committee of the House of Lords considered the Children's Life Insurance Bill, which was introduced by the Bishop of Peterborough (afterwards Archbishop of York). Many witnesses were examined, but there was no convincing evidence of any specific cases of child murder by parents for the sake of the insurance money. The Bill was eventually withdrawn.

Perhaps the only really unsatisfactory part of Industrial Assurance at the present time is the lapsing of policies, unsatisfactory to the assured and Assurance Office alike, for it must be remembered that Assurance Companies would always prefer that the assurance should be continued. To the great majority of working people the whole subject of assurance is a mystery. If a policyholder dies after a comparatively short period of assurance the claim is promptly paid, and no question is asked as to where the money comes from: but if a man, after being assured for many years, tires of his contract, he will persist in regarding his assurance as a Penny Bank, and he endeavours to make (or get someone else to make for him) a calculation as to what his pennies would have amounted to had they all been accumulated at 5 per cent. compound interest (everything is 5 per cent. in this sort of calculation). The result is to show that he has been grossly swindled out of a very large sum of money. Once this kind of calculation has been made, it is almost useless to talk to him of a free policy, he discontinues paying his penny or pennies, and spends the money on stamps instead, writing up to the chief office. I well remember one such letter, which ran something like this: "You will, of course, say that I might have died, and so have received the sum assured, but this, Sir, is only foolish talk, because you see I am not dead, thank God."

No doubt some of you have frequently had occasion to point out that it is evident, in order to pay the claims which constantly arise, a certain portion of each premium paid must be deducted, and if some persons receive much more as a claim than they have paid in, it is evident that some must pay in more than they receive. And again as to the Penny Bank argument, that it must be

evident that the two transactions are of an entirely different nature. But apart from this the question may well be asked, "Would they have put their penny a week in the bank, even if inclined to do so, and do they really think that the bank manager or his clerk would have called upon them every week for it?" They could of course post it to the bank, but then there would be the cost of postage to deduct as well as envelopes and paper. There would be also the trouble of going to the pillar box (unless there should be one outside their front door). As to the rate of interest obtainable, they could not invest their money in any bank offering the same security as a large Industrial Assurance Company at any higher rate than 2½ per cent., and even that rate may very possibly be reduced in the future. The Company would not be acting fairly if it returned the full reserve value or its equivalent to those who wish to withdraw, because it is well known that on the average those who withdraw are a better class of lives than those who remain, and consequently the greater the number who withdraw the higher will probably be the rate of claim amongst those who remain. If his weekly premiums should be more than a few pence (in which case the argument as to banking would become less obviously absurd) there is nothing to prevent him taking out an Ordinary policy, by which means he will get his assurance at a cheaper rate. Moreover, if the Industrial policy is held in a Company which also transacts ordinary business, special terms can be obtained for any policy transferred. The rates charged for Industrial Assurance must necessarily be much higher than for Ordinary Assurance owing to the cost of collection. Many people who make violent attacks on Industrial Assurance seem to insinuate that the whole amount paid is subject to no deduction for expenses. A person who pays 1d. per week and has a collector call upon him for that amount must be most unreasonable if he complains because he is charged rather more than a farthing out of the penny for the convenience of having it collected. He often buys a box of matches in the street for a penny, but I have never yet seen any calculation as to how much a man would save in his lifetime if he occasionally bought a large quantity at wholesale rates instead of buying them in small quantities as required. I am not, however, going to attempt to supply this calculation, as it is no more likely that people would dispense with the convenience of having a box of matches put into their hands when required in exchange for a penny than it is that

a man would every week go out of his way to pay an Industrial premium.

There are innumerable things constantly purchased by everyone for a few pence without any question as to their actual wholesale value: the object is required in a convenient form, and we are content to pay the vendor a price which will repay him for his trouble of supplying us in small convenient quantities; but I would venture to suggest that the pennyworth of Industrial Assurance is amongst the cheapest of these everyday necessities, and the English people know this fact too well to permit of its withdrawal.

JOSEPH BURN, F.I.A.

Bristol Insurance Institute,
January 31, 1902.

[*The Author begs to acknowledge the courtesy of the Editor of the "Commercial World and Insurance Budget" in allowing the use of the illustrations appearing in this Paper.*]

FIRE EXTINCTION EXPENSES.

I SHOULD like to express my sense of the honour conferred upon me by this Institution, of which I am proud to be able to say I am a member, in asking me to read a paper before you to-night. The subject of Extinction Expenses is one upon which I find it difficult to say very much that is new. Moreover, though in more senses than one a burning question, it is one which perhaps does not appeal to the general staff of an Insurance Office so fully as those more important matters connected with the obtaining and rating of risks. I do, however, claim for my subject that it is one upon which all Insurance men who desire that fuller grasp of their business which it is the object of this Institution to afford them should know something. This being so—and I think we may take it that our Council would not have asked us to devote an evening to an unprofitable subject—I candidly confess I am glad to be allowed the opportunity of addressing you upon a point of Insurance business to which I have devoted considerable study.

The history of organised effort to check the ravages of fire, so far, at any rate, as this country is concerned, commences at about 1666—the date, I need scarcely remind you, of the Great Fire of London. Previous to that time the matter appears to have been left principally to Providence, though, no doubt, from the earliest years of civilisation the necessity for some measures of protection must have been felt; but such attention as our ancestors gave to the matter appears to have been rather towards preventing fires, as witness the enactment originated by King Alfred, known later as the Curfew, which was unquestionably a precaution against fire. Then, again, in the reign of Richard I. it was ordered that party walls in the City of London were to be 16 feet in height at least, and 3 feet in breadth, and were to be built of stone, for security against fire. The following rules were also drawn up about this time by the authorities of the City of London :—

Item. "That all persons who dwell in great houses within the "ward have a ladder or two ready and prepared to succour their "neighbours in case misadventure should occur from fire."

Item. "That all persons who occupy such houses have in the "summer time, and especially between the Feast of Pentecost "and the Feast of Bartholomew [24th August], before their "doors a barrel full of water for quenching fires, if it be not a "house which has a fountain of its own."

Item. "That ten reputable men of ward with the Alderman "provide a strong crook of iron with a wooden handle, together "with two chains and two strong cords, and that the handle have "a good horn and loudly sounding. Of such persons wandering "by night it is forbidden that any person shall be so daring as "to be found wandering about the streets of the City after the "curfew ring out at St. Martin's-le-Grand at St. Lawrence upon "pain of being arrested."

These rules appear to have fallen more or less into disuse, as they were renewed in 1246. All houses within the City were ordered to be covered with tiles or slate, instead of straw, more especially those which stood in or near the best streets. In those days there were not many good streets in the City of London.

In 1285 (time of King Edward I.) an Act was passed against incendiarism, and it was ordered that night watchmen should be appointed in every town and city, to be in the streets between sunset and sunrise.

In 1556 (time of Queen Mary) bellmen were ordered to be appointed in London. They had to ring their bells at night and call out, "Take care of your fire and candle, be charitable to the poor, and pray for the dead."

In 1668, two years after the Great Fire, the Common Council of London made certain regulations for preventing and suppressing fires, the chief of which were the division of the City and liberties into four quarters, each one of which was to be provided with 800 leather buckets, 50 ladders, 2 hand squirts for every parish, and 24 pickaxe hatchets and 40 shod shovels. The principal City Companies were to provide and keep in readiness 30 buckets, 6 pickaxes, 3 ladders, and 2 hand squirts of brass, and the other Companies buckets, &c., in proportion to their abilities as estimated by the Lord Mayor.

The Aldermen and citizens were also ordered to keep buckets, &c., in their private residences. Householders, at the cry of fire,

were to place a man and to hang out a lamp at their doors, and to provide water for use.

The hand squirt referred to in this order is described by Captain Shaw in his book on Fires and Fire Brigades. "It "consisted of a large cylinder," he tells us, "about 3 feet in length, "with a long nozzle projecting from one end, the whole body of "the instrument resembling in some degree a magnified wine "bottle, with the difference that at about a quarter of the distance "from what would be the base to the shoulder of the bottle two "semi-circular handles were attached, one on each side. Inside "this cylinder a piston was worked up and down by means of a "piston rod passing out through the opposite extremity, and the "other end of this rod was enlarged by a round metal knob or "plate. The syringe was filled in the ordinary manner, and then "the manipulator had to take hold of the handles, one in each "hand, and, pressing the enlarged head of the piston rod firmly "against his stomach, draw the handles steadily towards him, at "the same time having the nozzle towards the flames"—an instrument possibly not quite so effective as the modern steamer, but the requirements of that time differed almost as essentially, for in tracing the development of extinguishing appliances we are following the growth of commerce.

In 1672 a Dutch engineer, one Jan Van der Heide, designed a manual engine with flexible hose. This is probably the first recorded fire engine of later times.

From the ashes of the Great Fire of London sprang not only the first real efforts to cope with the ravages of the actual flames, but also the great enterprise of Fire Insurance. In 1696 the Hand-in-Hand first saw the light. In 1698 (Fire Offices, it may be noted by the way, then, as now, did not waste much time) the Hand-in-Hand, it is recorded, appointed firemen from amongst the River Thames watermen, and an organised attempt to deal with fires in this country first commenced.

In 1707 an Act was passed (6th Anne, Cap. 58), Section 1 of which provided that every parish was to "have and keep in good "order and repair, in some known public place within each parish, "a large engine and also a hand-engine to throw water for the "extinguishing of fires, and shall provide, keep, and maintain one "leather pipe and socket of same size as the plug or fire-cock, to "the intent that the socket may be put into the pipe to convey the "water clean and without loss, or help of bucket, into engine." A

gratuity of 15s. was to be paid to the turncocks where water shall be found on, or shall first come into the main or pipe where the first plug shall be opened at any fire, "and the first engine-"keeper which brings in a parish engine to help extinguish any fire, "if in good order and complete with a socket hose and leather "pipe, to be paid 30s.; the keeper of the second parish engine, 20s.; "and the third, 15s."

Section 2 contains a reference to the services of the watermen of the Insurance Offices, and a provision that they should not be subject to impressment.

This Act also provides (Section 5) for the attendance at fires of the constables and beadle of the parish, with their staves and other badges of their authority. Such were the regulations relative to the parish engine dear to the heart of the readers of Charles Dickens. In his "Sketches by Boz" he describes the manner in which it was worked.

"We never saw a parish engine at a regular fire but once. It "came up in gallant style—three and a half miles an hour at "least; there was a plentiful supply of water, and it was first "upon the spot. Bang went the pump; the people cheered; the "beadle perspired profusely; but it was unfortunately discovered, "just as they were going to put out the fire, that nobody under-"stood the process by which the engine was filled with water; "and eighteen boys and a man had exhausted themselves in "pumping for twenty minutes without producing the slightest "effect."

The system inaugurated by this Act practically continued in London until 1833. The Act did not stipulate that the engine should be in charge of competent persons who could effectively make use of it, so that the competition to be first at a fire was the chief and only consideration. Disputes often arose as to the claim for the reward, and not infrequently ended in a free fight, on which occasions, of course, the fire, as being of minor importance, had to take care of itself.

It has even been recorded that a parish engine was for some time in charge of a woman, a certain Mrs. Smith, the widow of a former engine-keeper; and a writer in the *Quarterly Review* for December 1854 relates that "Mrs. Smith might be seen at "conflagrations, hurrying about in her pattens, directing the "firemen."

Each Insurance Office had also its own engine and complement

of firemen. The engines were painted distinguishing colours, the firemen wearing the badges of the respective Offices to which they belonged, the system of encouragement adopted by the Act of Queen Anne being continued by the Offices. As time went on, the number of engines belonging to the Fire Offices increased. These were in charge of active watermen specially retained for the purpose, whereas the parish fire engines were under the care of the beadles, generally aged men, and seldom arrived in time to claim the reward, and so the latter gradually dropped out of the running. In 1833 the London Fire Engine Establishment was formed. It consisted of 76 officers and men, and was supported by the following Offices:—The Sun, Protector, Imperial, Westminster, Atlas, Alliance, London, Royal Exchange, Union, Globe, Phœnix, and Guardian. And so it came about that what was by statute a public duty, by default on the part of those responsible devolved upon the Fire Offices, who in their own interests took upon themselves the fire protection of London.

As bearing directly upon the attitude held nowadays by the Fire Offices with respect to the cost of fire protection and fire extinction, it is interesting to note that so far back as 1834 a correspondence took place between the Insurance Companies and the Government showing that the brigades were maintained in the special interests of the Companies, and that if two fires should at the same time require the services of the brigades the preference would naturally be given to the insured property, to the possible destruction of Government or other public buildings; and certain suggestions were made with a view to placing the parochial engines on an effective basis. These suggestions were ignored.

In 1860 the first land steam fire engine was constructed.

In 1861 occurred the great fire in Tooley Street, when Mr. Braidwood, the honoured chief of the London Fire Engine Establishment, lost his life. This fire, in which £1,300,000 worth of property was destroyed, proved to the Offices the inadequacy of the force to cope with fires of such magnitude. They realised that the time had now arrived when some new arrangements should be made, and the Government was again applied to. The Home Secretary was informed that the Insurance Companies could no longer be responsible for the safety of London from fire, as they considered it no more part of their duty to protect the lives and property of the people from destruction by fire than to guard them against thieves and murderers. They expressed their

determination to discontinue the maintenance of the brigade at an early date, at the same time very generously offering to transfer gratuitously the existing stations, engines, and plant to such authority as the Government might appoint.

This offer was made in 1862, but it was not until 1865 that a bill was passed in Parliament transferring the old London Fire Engine Establishment to the Metropolitan Board of Works. By this Act (Metropolitan Fire Brigades Act, 1865) provision was made for the necessary working expenses—first, by contributions from the Insurance Companies at the rate of £35 per every million pounds gross insured on property within the Metropolitan area; second, by a grant from the Treasury; and third, by a parochial rate. Thus it was that the Fire Offices have in London come to occupy the anomalous position of contributing towards the cost of fire protection, albeit in the same year that they relinquished the work of fire extinction; they found it desirable to have some representative body to protect their interests at fires, and the London Salvage Corps was accordingly started.

The sum contributed by the Offices to the M.F.B. in 1899 was £32,640.

So far we have considered the progress of fire protection in London. In the provinces Offices also took the matter in their own hands and provided for themselves, and the public to boot, fire protection, so far as they were able and the necessities of the case demanded it, and in some districts these engines remain to the present day—fewer in number, however, and gradually less as public opinion has slowly forced Local Authorities to use the powers granted them by Parliament.

We have now to consider what these powers are, and in so doing it must be carefully noted—(1) That the adoption of the powers conferred by Parliament is at present permissive—that is that statutes extant do not say "must" or "shall," but merely "may" or "can" provide, maintain, and send engines, and so forth; (2) that legislation so far as it exists on this very important question is scattered about here and there in unrepealed sections of otherwise defunct Acts of Parliament. The oldest general provisions now existing in this connection are contained in Section 44 of the Lighting and Watching Act of William IV. (1833). This applies at the option only of the inhabitants of any parish or district in England and Wales, and empowers officers acting under the provisions of the Act to provide and keep up

fire engines, with proper appliances, and to provide a proper place for keeping same, and to pay proper persons to look after same, the cost to be paid out of the rates.

But the most important provisions, as being those most generally applying to the Local Authorities (Parish Councils excepted) of England and Wales, are contained in Sections 32 and 33 of the Towns Police Clauses Act, 1847. These sections are now incorporated in and form part of the Public Health Act, 1875. The Towns Police Clauses Act, it may be well to explain, was originally intended to apply only to towns and districts comprised in any special Act which might be passed thereafter incorporating it, the Commissioners referred to being officials appointed to administer the provisions of such local Act.

Section 32 provides:—"That the Commissioners may purchase "or provide such engines for extinguishing fires, and such water "buckets, pipes, and other appurtenances for such engines, and "such fire escapes, and other implements for safety or use in case "of fire, and may purchase, keep, or hire such horses for drawing "such engines as they think fit, and may build, provide, or hire "places for keeping such engines with their appurtenances, and may "employ a proper number of persons to act as firemen, and may "make such rules for their proper regulation as they think proper, "and give such firemen and other persons such salaries and other "rewards for their exertions in cases of fire as they think fit."

Section 33 empowers the Commissioners to send the engines outside the district, and provides for the payment of reasonable charges for so doing:—

"The Commissioners may send such engines with their "appurtenances, and the said firemen, beyond the limits of the "Special Act, for extinguishing fire in the neighbourhood of the "said limits; and the owner of the lands or buildings where such "fire shall have happened shall, in such case, defray the actual "expense which may be thereby incurred, and shall also pay to "the Commissioners a reasonable charge for the use of such "engines with their appurtenances, and for the attendance of "such firemen, and in case of any difference between the "Commissioners and the owner of such land or buildings, the "amount of the said expenses and charge, as well as the propriety "of sending engines and firemen as aforesaid for extinguishing "such fire—if the propriety thereof be disputed—shall be "determined by two Justices, whose decision shall be final; and

"the amount of the said expenses and charge shall be recovered "by the Commissioners as damages."

By the Poor Law Amendment Act, 1867, Section 29, it is enacted that if the Vestry of any parish where there is no Town Council, Local Board, or other authority competent to provide the same, after due notice, shall resolve that the overseers (*i.e.* overseers for the relief of the poor) shall provide any engine, ladder, or fire escape for general use in the parish, the overseers shall provide the same, and pay out of the poor rate the cost thereof, and of procuring a proper place wherein to keep the same, and of maintaining it as well as any such engine, ladder, or escape, acquired by the parish in any other manner for such use, in a fit state of repair, and the charges of such persons as may be necessary for the use thereof, and the cost of suitable implements and accoutrements.

This section is now incorporated in the Local Government Act, 1894, by which Parish Councils are empowered to take over the duties of the overseers in respect of the provision of fire engines, etc.

In order to enable parishes not large enough to maintain an engine and brigade of their own to make some provision for protection against fire, a short Act was passed in 1898, entitled the Parish Fire Engines Act, empowering a Parish Council to enter into an agreement with a neighbouring borough for the use of any fire engines and their appurtenances, and firemen, for extinguishing fire in the parish. Section 2 provides that where a fire engine is sent beyond the limits of a borough or district in pursuance of any such agreement, the owner of the lands or buildings where such fire occurred shall not by reason thereof be liable for any expense or charge under Section 33 of the Towns Police Clauses Act, 1847. Arrangements under this Act are becoming very general all over the country, and it has therefore become necessary to enquire whether any such arrangement exists in dealing with the charges for attendance outside the district, as any charge for use of engine or services of brigade cannot under the circumstances be enforced.

By the foregoing sections the principle is distinctly laid down that protection of life and property from fire is the duty of the local government, the cost to be defrayed by the ratepayer who is the beneficiary. In only one instance is reference made to charges for services and expenses at a fire—viz., in Section 33 of

the Towns Police Clauses Act, in which the cost again falls on the presumable beneficiary, the owner of lands or buildings on which the fire occurred.

Besides these general provisions, certain towns have obtained special powers under Act of Parliament, notably Liverpool, Salford, and Manchester, whereby the expense, not of maintenance as in the Metropolis, but of attending fires, is thrown upon the Insurance Offices where the property at risk is insured. Under the Salford Improvement Act, 1862, Section 274, it is provided:—

"That all extraordinary expenses occasioned by any fire shall "be borne by, and amongst all, the respective Insurance Offices "who have insured against fire property endangered, or to which "assistance has been given or extended by such Fire Police "Establishment, and by, and amongst all, the respective owners of "uninsured property endangered, or to which assistance as "aforesaid has been given or extended, in fair and equal pro-"portions."

By "extraordinary expenses" is implied all expenses incurred in connection with a particular service rendered. It is further provided that if a sum insured be less than the value of the property the Office shall only be liable to contribute in the proportion which the sum insured bears to the whole value, the owner being liable for the remainder. The cost of attending fires outside the borough is thrown upon the owner of the property upon which the fire happened.

The Tariff Offices have commuted their liability under this section by payment of an annual subsidy of £325 to the borough authorities.

The Liverpool Police Management Act also throws the cost of attending fires within the limits of the Act upon the Offices where the property is insured. The provisions are similar to those of Salford. The Offices have also commuted their liability here by an annual contribution of £1000.

In Manchester also powers are conferred by Parliament for the recovery from the Offices of the expenses incurred in attending fires within the borough, a special arrangement having been come to between the Insurance Companies and the Corporation, the annual payment in this case being, I believe, £2000.

The Birmingham Fire Brigade is formed under the Police Clauses Act, but in Birmingham Corporation (Consolidation) Act

of 1883 there is a clause (No. 149) having reference to the Fire Brigade:—

"(1) On the occasion of a fire the Superintendent, or other officer "in charge of the Corporation Fire Brigade, may, in his discretion, "take the command of any Volunteer Fire Brigade or other persons "who voluntarily place their services at his disposal, and may "remove, or cause to be removed, any persons who interfere by "their presence with the operations of the fire brigade, and "generally he may take any measures that appear expedient for the "protection of life and property, with power by himself, or his "men, to break into or through, or take possession of, or pull down "any premises, for the purpose of putting an end to a fire, doing as "little damage as possible.

"(2) Such Superintendent or other officer may also on such "occasion cause the water to be shut off from the mains and pipes "in any district in order to give a greater supply and pressure of "water in the district in which the fire has occurred, and the "Corporation shall not be liable to any penalty or claim by reason "of interruption of the supply of water occasioned only by com-"pliance with the provisions of this section" (1).

Amongst other English towns enjoying special privileges may be mentioned Oldham, Ashton-under-Lyne, and Newcastle-upon-Tyne; but in dealing with the brigades of many of our ancient boroughs it is always desirable to enquire carefully whether they are constituted under a special Act.

So far we have reviewed the powers afforded by the Legislature to Local Authorities generally, and certain cities in particular, for the provision and maintenance of appliances, equipment, and men for the purposes of fire extinction. The position of volunteer and private brigades is unaffected by these Acts of Parliament, any right they may have to charge for services being governed by the ordinary laws of contract. It will be seen, therefore, that it is important, in considering the charges of a brigade, to understand clearly the powers under which such charges are levied, as determining the right to charge for services, and, if such right exists, the person upon whom the liability for payment falls. For this purpose fire brigades may be roughly divided into five classes, as follows:—

(1) Where a brigade is constituted under a special Act of Parliament, as in the case of the Metropolitan Fire Brigade and the Liverpool, Salford, and Manchester Brigades already referred to.

(2) Where powers are taken under the Towns Police Clauses Act, or Public Health Act, by a Municipal or Urban District Council. These are generally known as "retained" brigades.

(3) Where powers are taken by a Parish Council under the Local Government Act, 1894.

(4) Where a brigade, independent of the Local Authority, publishes a scale of charges and enters into a contract for payment of same, actual or implied. This class we may call "contracting" brigades.

(5) A volunteer brigade pure and simple, giving its services.

A large majority of the brigades of England and Wales are those retained by Local Authorities. Parish Councils, I may state at once, have no statutory powers for making any charge for their services or use of appliances, whether inside or outside their districts, though there is no doubt that they have a right to contract for payment of a published scale for services rendered outside the parish, and we will therefore consider them under the head of Contracting Brigades.

The cost of maintenance of retained brigades within the district, and their right to charge for services rendered outside it, is regulated by Sections 32 and 33 of the Towns Police Clauses Act, 1847, which I have already quoted at length. The right of a Local Authority to charge for use of engine and appliances and for services of firemen under Section 32 has been successfully contested on two occasions, and it has now become the fairly general practice of the Offices to pay a reasonable charge for services rendered and expenses incurred within the district as an acknowledgment of benefit received, although it is absolutely clear that a ratepayer is entitled to the services of the brigade, in respect of which he pays his rates, free of charge; in fact such service, in a measure, has already been paid for out of the rates, and any further payment in the nature of special charges practically goes into the pockets of the ratepayers, whether insured or uninsured.

As regards services outside the district, it will be noticed that under Section 33 "the Commissioners may send such engines "with their appurtenances, and the firemen, beyond the limits of "the Special Act," and "the owner of lands or buildings" where such fire shall have happened "shall defray the actual expenses, "and shall also pay a reasonable charge for the use of such engines "with their appurtenances, and for the attendance of such firemen."

The meaning of the word "owner" under this section has on two occasions been a subject for the decision of the Courts. On the first occasion, in Lewis *v.* Arnold, it was decided by the Court of Queen's Bench that the occupier was liable. This ruling was, however, reversed in the case of Sale *v.* Phillips (1894), when it was laid down that the owner within the meaning of the Act is the owner of the rack rent: and it is a marvel to one not versed in the mysteries of the law how the question ever came to be referred to the decision of the Courts at all, as Section 4 of the Public Health Act (Sections 32 and 33 of the Towns Police Clauses Act I have already stated are incorporated by Section 171 in this Act) carefully and explicitly defines the word "owner" as the owner of the rack rent.

As a result of this decision, in the case where a brigade attends a fire outside their district in which no buildings are endangered, the "owner," although receiving no benefit from the services rendered, is liable for the brigade charges, and can be proceeded against for the recovery of the same. This anomaly not infrequently occurs in the case of farm fires, and if the Office which indemnifies the occupier of the farm against loss stands only in the position of their Assured, it is clear they are not called upon to pay the brigade charges for extinguishing the fire. If, however, it is clear that benefit was derived from the services of the brigade, the custom has been to pay their reasonable charges without calling upon the Office insuring the owner to contribute, unless, of course, buildings were endangered.

The other points to be noted in connection with this section (Section 33) are—

(1) The Commissioners *may* send engines, no call to attend being necessary; though the "propriety" of sending such engines and firemen is open to dispute.

(2) That charges shall be reasonable, so that a Local Authority has no legal power to force an outrageous scale of charges down the throats of the public.

The tribunal laid down by this section is two Justices. The Public Health Act, however, by Section 261, confers on the County Court the same powers in all cases under £50 as given to the Justices by any previous enactment. Before leaving this question of attendance at outside fires, I should like to remark that a doubt has often arisen in my mind whether a brigade ought to leave its own district at all, except under a special arrange-

ment, if by doing so it leaves the district it is organised to protect, perhaps for many hours, without adequate fire protection, to the prejudice of the ratepayers, and the Offices who would be called upon to pay the piper in case of an outbreak.

We now come to the consideration of Contracting and Volunteer Brigades.

Under one or the other of these headings come all those brigades not retained by a Local Authority, or taking powers under a special Act of Parliament, whether describing themselves as a volunteer fire brigade, or merely taking the name of the district or town which they serve, or being the property of corporate bodies or private individuals. The difference between the two classes, from the point of view under consideration, is that the former—the contracting brigade—is entitled to charge for its services, and the latter—the volunteer brigade—is not. This difference does not lie, as might be supposed, in the title of the brigade, but in the right, under common law, to enter into a contract to charge for use of engine and services. The right is obtained by publishing a scale of charges, the general method adopted being to affix such scale to the door of the engine-house, or in some conspicuous place in the district. The persons employing a brigade whose scale is so published are liable for payment of such charges. Some brigades insist upon a written request to attend a fire, but it has been generally held that to summon a brigade constitutes an implied contract. A brigade using the word "volunteer" in its title is not debarred from entering into a contract to charge for its services, but it must advertise the fact that payment is expected, otherwise its title would be a guarantee that its services were rendered free of charge. To authorise a brigade upon its arrival to get to work, whether summoned or not, would be sufficient contract for payment. It may be useful to note, with regard to volunteer brigades, that they are responsible for damage done by them at a fire.

A plan adopted by many Local Authorities is to provide a fire engine and appliances out of the rates, leaving the organisation of the brigade, and the maintenance of the engine and appliances, entirely to the voluntary efforts of the residents within the district, the necessary funds being raised partly by charges for services rendered at fires, and partly by voluntary contributions. But partial discharge of the responsibilities imposed by Parliament is not recognised by law, it being decided, in the case of the Bourn

Parish Council *v.* Bettinson and Gardiner, that a Local Authority cannot adopt part of an Act, but a brigade so constituted is a Local Government Brigade. Further, an Urban Council may not legally give a subscription or donation to the funds of a volunteer brigade.

I have already called attention to the fact that where reference has been made by Parliament to the payment for attendance of brigades at fires, as in Section 33 of the Towns Police Clauses Act, the words "reasonable charges" have been used, and it is in the light of these words that the various items that go to make up a fire brigade account have to be considered, it being clearly the intention that in this, as in other business transactions, the basis of payment should be upon the service received, not that the sufferer by a fire should be made to bear an undue proportion of the cost of maintenance of the brigade in the district.

In considering what is a reasonable charge for use of engine, hire of horses, services of firemen, and so forth, it must be borne in mind that an Office is always perfectly within its rights, whether there be any legal liability on the part of the Assured or not, in declining to entertain an application for services rendered in extinguishing a fire on property insured with them; indeed, this is not infrequently done in cases where a total loss has been paid, on the ground that there are no funds left wherewith to meet such charges.

There is probably no item of a fire brigade account which varies more than the charge for the use of engine; judging from some of the charges that have come before me, some brigades expect to recover the value of the machine whenever it attends a fire. Experience has shown that a fair average charge in all cases is, for use of a steamer, £5 5s.; and for a manual, £2 2s. The latter being less powerful and involving the additional expense of pumpers is naturally rated at a much lower figure than the former. The above amounts should include cleaning, which is frequently made the subject of an additional charge. The principle of an hourage charge for use of engine should not be recognised.

The question of remuneration of pumpers and general helpers at a fire is an important one to the Fire Offices, as there can be little doubt that there have been cases in which the too liberal payment of these persons has acted as an incentive to further outbreaks of fire. In paying "helpers," the prevailing rate of

wages in the district should be taken into consideration—in agricultural districts from 4d. to 6d. an hour, according to the time of the year, being generally regarded as ample. In or near towns, where wages rule higher, it may sometimes be necessary to pay rather more, but under no circumstances should the payment be on such a scale as to render a fire a desirable contingency.

The charges for services of officers and firemen are very variable, every brigade having its own scale. The public are not, however, bound to recognise these scales—unless a contract has been entered into to pay certain charges—the most satisfactory plan to adopt in dealing with this item of the account being, so far as possible, to fix upon certain reasonable charges to be applied in all cases. The charges generally recognised as reasonable are, for the officer in charge, £1 1s. to £2 2s., according to the length of the service—the former is usually regarded as sufficient—and for the firemen, for the first hour 2s., and for each subsequent hour 1s. All but the chief officer should, for the purposes of payment, be ranked as firemen.

Watching is frequently the subject of a charge entirely out of proportion to the service rendered. In dealing with this item of an account it should be borne in mind that for the services of a trained member of the Salvage Corps in London only 8s. 6d. per day and night is charged.

Horse-hire is an item of these accounts which often gives rise to discussion, and whilst it is recognised that exceptional strain is placed upon horses in dragging a heavy engine at a high rate of speed along a not always level country road, this scarcely forms an adequate excuse for the exorbitant charges which are frequently made. £1 1s. per horse used should amply remunerate the owner of the horses. Four horses are generally required for a steam fire engine, whilst two are regarded as sufficient to horse a manual. The practice usually adopted by fire brigades is to enter into a contract with a local jobmaster for the supply of horses, so much for each turnout being charged, without regard to the time they are away.

Although it is only reasonable that the firemen and helpers employed at a fire, in the course of prolonged and arduous duties, should be allowed proper and sufficient refreshments, the supply of food and drink, particularly the latter, is sometimes so far in excess of the requirements of the case that fires have, in consequence, obtained an element of undesirable attractiveness.

This is especially the case in country districts, where the residents of the surrounding neighbourhood flock in large numbers to the scene, which not infrequently seems to be regarded in the light of a public beanfeast at the expense of the Insurance Office. All accounts for refreshments should, therefore, be carefully considered in detail, with a view to checking the amounts supplied and the prices charged.

An item which not infrequently figures in fire brigade accounts is a charge for "call," *i.e.* giving the first alarm of fire. The payment of this fee, generally 2s. 6d., was long since discontinued in the Metropolis, as it was found that certain disreputable persons made a practice of raising fires in order to earn the call fee. In the interest of the public, therefore, as well as of the Offices, this charge should always be disallowed.

Another item, the payment of which is questionable, is a fee or turncock's services; but, whilst this official has no right whatever to demand, or expect, a fee for a service which is provided for in his ordinary wages, it is often argued by the fire brigades, and with some show of common sense, that a small donation, as an incentive to extra expedition in the execution of this branch of his duties, is not always money unwisely spent.

Demand is sometimes made by brigades in their accounts for remuneration to "police," either for summoning brigade or services at a fire. As any payments to the county or borough police, without the express sanction of the officer commanding the district, is contrary to the regulations of the service, such payments should always be discountenanced.

It is the custom of some brigades, when summoned to attend a fire outside their district, to leave three or four members of the brigade—the number is generally regulated by the standing rules of the brigade—in charge of the fire station, to be available in the event of a further emergency arising in the district. These men are usually charged in the account for services rendered at the fire at the rate of from 2s. 6d. to 5s. per man, under the head of "Home Watch." As, however, the services rendered, if any, are to the district at large, there appears to be no reasonable ground for including such a charge in an account rendered for services at a fire at which they were not present.

A charge is generally made for calling firemen. This sometimes takes the form of a charge for a proportion of the cost of maintenance of a telephonic or electrical communication with the

houses of the members of the brigade. In view of the fact that every minute is of value in the early stages of a fire, it may be considered worth while on the part of the Offices to encourage promptitude in turning out.

An item which sometimes figures in these accounts is a charge for renewing hose or other plant, or firemen's clothing, damaged or destroyed in the course of operations at a fire. If the fire is within the district of an urban or borough brigade it is hardly necessary to point out that this charge is unauthorised. If outside the district, it is as well to make enquiries as to the age and condition of the plant damaged, and how the damage was occasioned. All claims for worn-out or otherwise worthless plant, or for damage occasioned through unskilful handling, should, of course, be repudiated. In any case, it may not unfairly be argued that the charge for use of engine and appliances should cover any damage which may arise to them during their employment.

In general consideration of the charges of a brigade it is well to consider the nature of the service rendered, for whilst Offices undoubtedly do derive advantage from the services of an efficient brigade, which they are generally willing to liberally recognise, a badly equipped or inefficient brigade will not only be of no use, but may through want of knowledge do more harm than good. And not only this, but so long as they retain a position which should be occupied by properly equipped and trained men, they are a menace to the neighbourhood they are supposed to serve. Such institutions cannot be too severely discouraged.

The apportionment of extinction expenses between the Offices insuring the property at risk is a universally recognised practice; the basis of contribution being upon the sum insured on property at risk, except in the case of farming stock, the value of property endangered being then taken as a proportionate interest at stake. Some Offices, as already stated, decline to contribute in any way towards the cost of extinguishing a fire where a total loss under a policy has been paid. I am not aware that any of the Offices, in estimating the value of agricultural produce in risk of a fire, take advantage of the special condition of average where this is applicable, or that they follow the strict letter of their liability so far as excluding the value of a stack which has fired from spontaneous combustion. Either of these might with a good show of reason be done, but it is the usual custom under such circumstances to err, if anything, on the side of liberality.

A brief reference to the important question of water supply at fires would not, I think, be out of place in this paper.

Considerable care has been taken by the Legislature in granting powers to Water Companies that every facility shall be afforded for obtaining a proper supply of water in case of fire, though unfortunately, through neglect or parsimony on the part of the authorities in some districts, the fire hydrants when required are only too frequently found to contain anything but a proper supply. By the Towns Improvement Clauses Act, 1847, Section 124, incorporated in the Public Health Act, 1875—

"The Commissioners shall cause fire-plugs and all *necessary* "*works, machinery, and assistance* for securing an efficient supply "of water in cases of fire to be provided and maintained, and for "this purpose they may enter into any agreement with any "Water Company or other party, and they shall paint or mark on "the buildings and walls within the streets, words or marks "near to such fire-plugs to denote the situation thereof, and do "such other things for the purposes aforesaid as they may from "time to time deem expedient."

It has been argued that this section makes it obligatory upon a Local Authority in the use of the words "all necessary works, machinery, and assistance" to provide a fire engine and properly equipped brigade, but in view of the fact that Section 32 of the Towns Police Clauses Act is unrepealed, this contention would hardly seem feasible. But the most important provision on this head is contained in the Water Works Clauses Consolidation Act, 1847, 10 & 11 Vic., cap. 17 (an Act intended to be incorporated by reference in Special or Local Acts sought after that date).

Section 42 of this Act provides that the Water Company "shall "at all times keep charged with water under such pressure as afore-"said" (as will make the water reach the top storey of the highest house within the district) "all their pipes to which fire-plugs shall "be fixed, unless prevented by frost, unusual drought, or other "unavoidable cause or accident, or during necessary repairs, and "shall allow all persons at all times to take and use such water "for extinguishing fire, without making compensation for "same"; from which it will be noticed that any charge for use of water at a fire within the district in which the Water Company has obtained powers under this Act is illegal, and, if made, should be resisted accordingly. A fire brigade has, however, no right to take water from ponds, wells, or other private sources for extinguishing purposes.

Section 43 provides for a penalty for neglecting to maintain fire-plugs, or furnish sufficient supply of water, or neglecting to keep the pipes charged, or refusing to supply any owner or occupier.

Reference has been made more than once in the course of this paper to the position taken up by the Fire Offices in respect of contribution by them to the cost of fire protection and of extinguishing fires. Some interesting evidence was given on this subject before the Select Committee of the House of Commons of which Mr. Jesse Collings was chairman, and I feel I cannot do better than quote from the Report of the Committee, which appeared about two years ago.

"Mr. H. E. Hall, chairman of the Fire Offices Committee, "London, gave lengthened evidence in opposition to the contention "that Insurance Companies should be legally called on to con-"tribute to the expenses of fire extinction.

"He stated that the practice of the Offices differs with respect "to contribntions for fire purposes, but that it was a pretty "general custom to pay for the attendance of fire brigades for "work done outside the areas to which these brigades belong; "that these payments were purely voluntary, and that the "Insurance Offices would have the strongest objection to having "any legal liability placed upon them.

"Mr. Hall added, 'Our position is that we have to take risks "'as we find them, and that we have nothing whatever to do with "'fire extinction or the provision of fire appliances.' This "appears," the Report goes on to say, "to be a somewhat new "position, as it was given in evidence that some years ago it was "the custom of Insurance Offices to provide fire appliances of their "own for the protection of property insured.

"On this point Mr. Hall states that 'a great many years ago "'individual Offices had engines of their own, when it was not "'recognised as it is now that it is a public duty to extinguish "'fires.'"

The Report, after reviewing evidence adduced to show that the Fire Offices reaped the benefits of the services of brigades at fires, again takes up Mr. Hall's evidence on another point.

"The Committee cannot find from evidence given before them "that Insurance Companies make any reduction in the premiums "for insurance in places where sufficient fire brigades are "established.

"Mr. Hall stated that Offices regulate their premiums according

"to the risks and losses as a whole, and not with reference to the "efficiency of the brigade in any district.

"No doubt," the Report admits, "it would be difficult for the "Companies to act otherwise. In Mr. Hall's words, it is very "difficult to say that because you have an inefficient fire brigade "in a particular district, therefore you must charge a higher rate "of premium. That would impose on the Offices the duty of "seeing whether in each particular locality the brigade was "efficient or not, and they could not do that.

"Mr. Hall also stated in his evidence that although some of the "older private Acts of Parliament contain provisions compelling "the Insurance Companies to contribute to the expenses of brigades, "yet that similar clauses in recent private Acts have almost "always been opposed by Insurance Companies before Par-"liamentary Select Committees, and that they have never once "failed in getting these obnoxious clauses struck out.

"The sum of evidence"—I am still quoting from the Report—"seems to be that Insurance Companies have discontinued the "practice of maintaining their own fire establishments; that they "realise the immense gains accruing from the saving of insured "property through the efforts of public and volunteer brigades; "that they make no corresponding return in the form of reduced "premiums, and that they are not legally required to contribute "in any way to the expense of fire extinction." The conclusion arrived at with regard to premiums is an index to the attitude of mind of the layman in respect to Insurance matters; if anything, it should have read—"That they make no corresponding increase "in the rate of premium in places where no fire protection "exists"; but, as a matter of fact, I venture to think neither statement would be absolutely correct.

The final conclusion of the Committee, "after a careful review "of the whole case as it has been placed before them," is that "all "Fire Insurance Companies should be required by law to bear a "certain portion of the expenses connected with fire extinction, "which is an obligation already recognised by some of the most "important Companies.

"They do not think there would be any difficulty in settling the "form in which the contributions should be levied. Perhaps the "more convenient way would be to legalise the method which Fire "Insurance Companies to such a large extent voluntarily adopt at "the present time.

"By this method Insurance Companies, in case of fire in "premises insured by them, would be required by law to pay for "the use of appliances and for services rendered at each individual "fire according to the local scale of charges, which apparently it "is the custom of most fire authorities to frame."

Of course it is a far cry from the Report of a Select Committee to an Act of Parliament, and whilst we may have every confidence in the ability of the Offices to protect their interests both in and out of Parliament, it is most certainly worthy of consideration that such a body, after sifting the evidence of so eminent a man as Mr. Hall, should find the position taken up by the Offices illogical. Despite what, at the dictates of policy, may have been stated at various times, the Fire Offices are deeply interested in this question of fire extinction, not only on account of the saving of loss accruing from an efficient fire brigade service, but because of the ever-increasing expenditure incurred in the payment of the heavy costs of extinguishing fires, which, argue as they please, they find themselves, not legally it is true, but practically obliged to pay.

It is, however, one thing to be in a position to say we will, as an act of grace, consider your charges and pay a reasonable sum, and another to be bound down to pay according to the local scale of extortion which we know from sad experience it is the custom of some fire authorities to frame; and the Committee in stating that it is the general practice of the Offices to pay according to these local scales shows an ignorance on their part of one of the most troublesome functions of a Loss Assessor, which, after many years of trying to do our duty, is very discouraging; for I think that it may be truly said of all Assessors in this country that amongst the unhappiest moments of their lives may be reckoned those spent in the consideration of extinction expenses, and that any settlement of a question which is always fraught with difficulty will be welcome.

Whether this settlement is near or yet far distant I am insufficiently versed in the intricacies of legislative procedure to dare to forecast. Parliament has admitted, by the appointment of a Select Committee, the importance of the question and the need of enquiry, and the Committee in their Report prove up to the hilt the need of legislation. "The existing enactments are," they state in their Report, "very obscure, fragmentary, and so "mixed up with other matter that they are liable to lose their

"force as legislation." They consider that the inadequate provision against fire shown to exist so largely throughout the country is due partly to apathy and partly to ignorance caused by defective legislation, and they recommend that an Act of Parliament should be passed repealing all previous Acts so far as they relate to fire, and conferring on fire authorities well defined powers to provide fire brigades and to make such other arrangements for protection against fire as they deem necessary.

Such an Act should leave no village, however remote, without some well-defined scheme of fire protection—1st, by simple and inexpensive appliances to be used in the early stages of an outbreak, and 2nd, by electrical or telephonic communication with the nearest fire station. For it is these outlying districts that are so difficult to protect—places where perhaps there are not two fires in a decade, but where a small fire, through lack of the simplest appliances and a man or two who knows how to use them, may assume alarming proportions. All fire protection should be compulsory on the Local Authorities, and the cost of providing and maintaining same and of attendance at all fires should fall on the rates. No brigade should be allowed to leave its own district, except upon receipt of a call from some authorised person responsible for the extinction of fires in the parish where the outbreak occurs, and any charge (which should be regulated by statute) for such attendance should fall upon the rates of the parish requiring extra assistance. This is, of course, the merest outline of what appears to me to meet the requirements of a complete recognition of the accepted principle that it is a public duty to protect the lives and property of the community against fire. Such a measure would define the various Local Authorities upon whom the onus of providing fire protection would fall, and the extent of the liability of each. It should provide for periodical Government inspection with a view to maintained efficiency, with power to inflict a penalty in case of default.

In the meantime the question how we may best resist exorbitant demands, when such occur, for fire brigade attendances at fires still remains to be decided. It is something, it is true, to be armed with the knowledge as to the rights, or otherwise, of the brigade to charge, and the proper amount of such charges, but when we would bring the brigade to reason we only too frequently find arrayed against us those very people whose support we feel we have every right to expect. The Assured, whose burden the

Office is taking voluntarily upon its shoulders, is surprised at our cavilling at any sum the brigade may see fit to ask for, and hints at removing his insurances; the agent fears the reputation of the Office will be dragged in the dirt and, what is more important to him, his connection imperilled; and the Office, rightly desirous to maintain its good name—a possession as valuable to Offices as to individuals—deems it expedient to meet the demands in full. The next time there is a fire in that district it is hopeless to look for any reduction in the charges, however high they may be.

There seems to me but one remedy for this state of affairs: the simple one of applying to the consideration of fire brigade charges the same combination that has for many years been so successfully applied to the consideration of the various questions that concern Fire Insurance Offices.

I would suggest a bureau or department by which all extinction expenses should be dealt with. By this means each account would be dealt with on its merits, by and on behalf of the associated Offices. Test cases, when necessary, would be fought in the interests and at the cost of all. By declining to pay charges in the district, and in other instances where no legal right to charge exists, Local Authorities would soon be brought to realise their responsibilities, with the result that very shortly a better understanding and more reasonable charges would prevail.

The only objection that can, so far as I can see, be raised to such a plan is that it might be regarded as some sort of recognition by the Offices of a liability on their part for payment of these charges for extinguishing fires; but so far as that is concerned, though I do not see that it need be so, it surely would be better to face the difficulty than to pay, as now, exorbitantly for the privilege of disclaiming a liability which is almost invariably met.

H. ORTON SMITH.

Birmingham Insurance Institute,
March 7, 1902.

EXAMINATION PAPERS—1902.

FIRE BRANCH.

PART I, SUBJECT A.—POLICY DRAFTING AND ENDORSEMENTS (CLOTHING FACTORIES TARIFF).

For this Examination one hour-and-a-half is allowed, and the use of the Tariff (but not the Tariff Proposal form) is permitted.

N.B.—Printed Warranties and Scale of Allowances must be used and attached to the Draft.

DESCRIPTION OF RISK.

Messrs. TWEED & SONS' Clothing Works, situate Station Road, Blanktown, England.

Brick and slated and skylighted, 7 storeys in height including basement (the ceiling and basement is 4 ft. above the ground line) wholly occupied by the Assured for the manufacture of clothing. The basement and ground floors are lined with matchboarding. Two wooden hoists through all the floors and a wooden shoot from 1st to basement floor. There are 18 stoves for heating pressing irons. The building is heated by a Blackman's Apparatus, the hot air being conveyed through metal ducts from a furnace (brick and iron) in a fireproof compartment in basement, and the lighting is by electricity and by gas. The Machinery is driven by two steam engines (in basement) supplied from boilers in a building adjoining and communicating by fireproof door only. There are 850 hands employed for the manufacture of clothing, and 55 for packing and other purposes. A small quantity (not exceeding 1 pint) of benzoline, kept in a properly-stoppered tin can, is used for removing stains from cloth. No waterproofing of cloth is done, nor are waterproof garments made. Cloth cuttings and clippings are kept in sacks and removed from the building every fortnight. No bisulphide of carbon is used or kept therein. No. 1 on plan.

Brick, timber and corrugated iron, lined with matchboarding, one storey in height, communicating with No. 1 by double fireproof doors only, used for the manufacture of waterproof garments, lighted by electricity and heated by two stoves—having not more than 3 ft. of pipe each. Rubber solution, naphtha, and bisulphide of carbon (sufficient only of each for one day's consumption) used No. 2 on plan.

and stored therein. Eighteen hands are employed, and manual power only is used therein. All refuse is removed daily.

No. 3 on plan. Brick and corrugated iron and roofed with felt, separated from No. 2 by a fire-proof passage 5 feet in length with an iron door at each end, 3 storeys in height, with wooden hoist from bottom to top of building, used partly for the manufacture of cloth caps and waterproof garments, and partly as counting-house (matchboarded). There are four gas stoves for heating irons, and on each floor there are (for warmth only) two Tortoise stoves, all with more than 3 feet of flue pipe. The lighting is by gas and electricity. Manual power only used, and not more than 30 hands are employed therein. Rubber solution (enough only for one day's consumption) is bought ready-made, but no benzoline, naphtha, or other mineral oil, wood spirit, or bisulphide of carbon used or stored therein. All clippings and cuttings, waste-paper, and other refuse kept in bags or bins, and removed once a week. No engine waste or wipes used therein.

There are kept or situate on the premises above mentioned the following appliances for extinction of fire, viz.:—Stationary fire engine, with hydrants attached (steam power always available); two hydrants in yard; hydrant (with sufficient hose) on each floor of said buildings; buckets, in accordance with Tariff requirements, distributed throughout; sufficient hose and water available at a minimum pressure to command the said premises. All fire appliances warranted to be kept in proper working order.

Draft the wording for a policy, and calculate the annual premium—showing the rates and how arrived at. Policy to be renewable at Christmas Quarter.

The proposed amounts are as follows:—

	No. 1.	No. 2.	No. 3.	
Building	£10,000	£300	£1,500	
Machinery	8,000	150	400	
Steam Engines and Connections	500	...	...	
Steam Boilers	...	...	...	
Internal Fixtures and Fittings	600	50	200	
Patterns...	100	50	150	
Stock-in-Trade	10,300	500	2,500	
Office Furniture	...	..	300	
				£35,600

Endorse policy allowing an additional 150 hands, and a securely fixed pipe stove (with 6 feet of flue pipe) in building No. 1, and show extra premium to Christmas, 1902, also the future annual premium.—25th March, 1902.

FIRE BRANCH.

PART I, SUBJECT A.—POLICY DRAFTING AND ENDORSEMENTS (BOOT AND SHOE TARIFF).

(*For this Examination TWO hours are allowed, and the use of the Tariff is permitted.*)

N.B.—Printed Warranties and Scale of Allowances must be used and attached to Draft.

WILLIAM JONES, of London Street, Lincoln, Boot and Shoe Manufacturer.

Boot and Shoe Factory, five storeys, brick and stone built and tiled or slated, wooden staircases from floor to floor; lighted by gas; heated by high-pressure hot water apparatus, and by three stoves, one having less than 3 ft. of smoke-pipe; rubber solution (contained in a proper air-tight vessel) used—and fake allowed to be made. 275 hands employed. No. 1 on plan.

Steam Engine and Boiler House, one storey, brick and stone built and tiled or slated; communicating by an ordinary doorway with No. 1 on plan. No. 2 on plan.

Boot and Shoe Factory, three storeys and attic, brick and timber built and tiled or slated; detached from Nos. 1 and 2 on plan. Having wooden linings to ceilings and walls; lighted by gas; and containing two stoves, each having more than 3 ft. of smoke-pipe, one used for drying or conditioning, and the other for heating shoemakers' wax. Boxmaking done therein. 175 hands employed. No. 3 on plan.

Gas Engine House, one storey, brick built and tiled or slated; communicating with No. 3 on plan by ordinary doorway. No. 4 on plan.

Warehouse and Office, four storeys and attic, brick built and tiled or slated; detached from Nos. 1 to 4 on plan—having hoist and wooden staircases through the floors, and wood linings to the ceilings and walls; heated by a stove with more than 3 ft. of smoke-pipe, and by three gas stoves; and lighted by paraffin lamps. 45 hands employed. No. 5 on plan.

All occupied by Insured, and situate as aforesaid.

Insurances in other offices.

Appliances—Buckets or cans, and portable fire pumps throughout, as per 8 and 9 of Tariff Scale.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Building	3,000	100	2,000	50	500
Steam, Gas, and Water Pipes and Fittings ...	100	...	50	...	...
Steam Boiler	...	200	...	...	...
Steam Engine	...	200	...	...	...
Gas Engine	...	...	...	200	...
Machinery and Gearing ...	2,850	...	1,900	...	...
Trade and Office Furniture	50	...	50	..	150
Stock-in-Trade	3,000	...	1,000	...	1,350

£16,750

From 25th March, 1902, to 25th March, 1903. Renewal at Lady Day.

Draft a Policy (showing rates in detail) and calculate the annual premium.

Endorsement.

On the 25th March, 1903, the Office is advised that—

No. 1 is now heated by low-pressure hot water apparatus, and only one stove has more than 3 ft. of smoke-pipe. The number of hands has been increased to 750.

No. 3.—Another pipe stove for warmth, having more than 3 feet of smoke-pipe, has been added. The number of hands has been reduced to 145.

No. 5 is now lighted by gas. The number of hands has been increased to 155.

Draft endorsement, showing future annual premium.

FIRE BRANCH.

PART I, SUBJECT B.—RE-INSURANCES.

(*One hour-and-a-half allowed for this Paper.*)

Questions.

1. What constitutes the Guarantee as defined by the Rules?

If a Guaranteeing Office is misled by error in the particulars supplied by the Insuring Office, what remedy has it?

2. Enumerate the successive documents necessary for the completion of a Guarantee transaction,

(*a*) On the part of the Insuring Office.

(*b*) On the part of the Guaranteeing Office.

3. What constitutes a valid notice relating to a Guarantee?

4. What is the time allowed an Insuring Office for the delivery of Specifications? Assuming the time to be exceeded, what right does the Guaranteeing Office acquire? Under what circumstances may the time for delivery be extended?

5. What is the effect of the words "Subject to Approval" on a Guarantee Acceptance?

6. In what respect do Acceptances by an Agent or Branch Official differ from those by a Head Office?

7. In the event of a Guaranteeing Office considering the amount of a Guarantee too large to retain, what course is open to it?

8. If a Guarantee Proposal is accepted, from what date does the liability of a Guaranteeing Office commence?

9. Explain the procedure with regard to Renewals of Guarantees after Annual policies.

10. What notice must be given by an Insuring Office of Cancelment of Guarantee,

(*a*) When the Insurance lapses?

(*b*) When the Insuring Office desires to retain the amount?

11. What notice must be given by a Guaranteeing Office of its inability to continue

(*a*) A Guarantee after an Annual policy?

(*b*) A Guarantee after a Short Term policy?

12. Office A. re-insures a portion of a Short Term policy with Office B. The policy is renewed, and three days thereafter a loss occurs, but no notice of renewal has been sent to Office B. Is Office B. liable?

FIRE BRANCH.

PART I, SUBJECT C.—GENERAL RULES FOR THE REGULATION OF FIRE INSURANCE BUSINESS.

(*Two hours allowed for this Paper.*)

QUESTIONS.

SECTION I.

1. To what Insurances is Section I applicable?

2. What is the minimum net rate for an Annual Insurance? And what the minimum net rate for short period insurances of six and three months respectively?

3. What articles of commerce must be excluded from all insurances on "Merchandise," not on Carriers' premises?

4. What provisions must be observed with regard to division of amounts in the case of insurance with plurality of risks, and what is necessary in the case of separate risks being insured for one gross sum?

5. Give in your own words, or quote, the terms of the *pro rata* Condition of Average, and show in full the operation of the Clause in the following example:—

> "The Insured A. has a Warehouse of six storeys, each of fireproof construction, containing goods valued at £6,000 in all. Office B. insures the whole contents for £4,000, subject to average?
>
> Suppose the contents of the Warehouse are damaged by fire to the extent of £3,000, what sum is B. entitled to pay to the insured?"

6. Give in your own words, or quote, the terms of the *second* of the two Conditions of Average (or of *both* if question No. 5 has not been answered), and show in full the operation of both Clauses in the following example:—

"The Insured A. has a Warehouse of six storeys, each of fireproof construction, containing goods valued at £6,000 *in all, the value on ground floor being* £1,500. Office B. insures the whole contents for £4,000, subject to the Conditions of Average.

Another Office, C., insures the contents of the ground floor only, under a specific Policy for £1,000.

Suppose the contents of the ground floor are damaged by fire to the extent of £1,250, what sums are B. and C. entitled to pay respectively to A?"

SECTIONS II. TO VI.

7. To what insurances are Sections II. to VI. applicable?

8. (*a*) Is an Office responsible for the act of an Agent when he infringes a Tariff regulation?

(*b*) In the event of any office infringing a Tariff rate or regulation, what must be done upon such infringement being discovered by that office?

9. (*a*) Suppose a Boot Factory to have been officially rated by the Fire Offices' Committee at 7/6°/₀ (Tariff rating) and that a Tariff Office having a Policy on the risk discovers, prior to the renewal term, that the number of Assistants employed in the Factory has been reduced since the date of issue of the Official rating—the correct Tariff rate being, at renewal term, 6/6°/₀. State fully what course the Office would observe.

(*b*) Suppose said Factory to have been *specially* rated by the Committee at 7/6°/₀ owing to some particular feature of hazard, and that, prior to the renewal term, the Office discovers that this hazard has been removed. State whether the Office is permitted to re-adjust the rate according to the Tariff without referring the matter to the Executive, or if not what course it should observe.

10. The contents of a Warehouse are insured for £5,000 at a Tariff rate of 5/-°/₀—A stove, in respect of which an additional charge of 1/-°/₀ is made, is used only during three months of the year, and is removed out of the building during the remaining nine months. The rate is made up as follows:—Normal 2/-, Stair 1/-, Wood-linings 1/-, Stove 1/-=5/-. State what rebate of premium, if any, should be allowed the Insured on account of the *removal* of the stove.

11. What conditions are deemed to constitute direct communication between adjoining buildings, and what openings may be allowed as exceptions under this category?

12. What are the Conditions under which the additional for "*Lighting*" is chargeable?

13. What are the Conditions under which the charge for "*Night Work*" is exigible?

14. State what requires to be done by Offices issuing or accepting Specifications over Tariff-rated Risks in view of their respective responsibilities.

15. Give in your own words the provisions of the "Marine Clause," or quote the terms thereof.

16. An Automatic Sprinkler Installation is fitted up in a Tariff-rated Mill, and the Insuring Office is requested to make an allowance therefor. What steps must be taken, and what provisions insisted upon by the Office, before such an allowance can be granted?

17. Specify the requirements of a "fireproof compartment"

(*a*) When used as a means of communication between buildings, and

(*b*) For all other purposes.

18. What does the term "Power" mean?

FIRE BRANCH.

PART I, SUBJECT D.—BOOK-KEEPING.

(*One hour-and-a-half allowed for this Paper.*)

1. What is Book-keeping?

2. Give a definition of Book-keeping by double entry.

3. What is the object of an oblique line frequently drawn on one side at foot of an account?

4. What is the significance of a Crossed Cheque?

5. Name the books through which a Fire Insurance would pass, in its progress through an office.

6. Determine the (1) loss and (2) expense ratio of the following results:

Premiums.	Losses.	Expenses.
£545,095	£310,458	£191,326
197,830	111,207	63,327
238,671	91,490	100,842

7. Suggest a method of keeping a Renewal Register, and give the headings of columns.

8. Suggest a method of keeping the Banking Acconnt, having regard both to efficiency and labour saving.

9. State the headings of the columns of a Fire Cash Book, Dr. and Cr. sides.

10. Distinguish between a personal and impersonal ledger by expressing the functions of each.

11. How would you arrive at the net premiums of a quarter's business (quarterly account), and what books would you suggest as most helpful to a direct method of obtaining the information.

FIRE BRANCH.

PART I, SUBJECT E.—ELEMENTARY CHEMISTRY.

(*Two hours allowed for this Paper.*)

QUESTIONS.

1. Describe experiments to show that in manifestations of chemical action no loss of matter occurs.

2. Define the terms *chemical symbol*, *combining weight*, *chemical formula*, and *chemical equation*.

3. Convert 150° F. into C.
„ 75° C. into F.
„ 110° C. into F., and give a short explanation of the method you adopt.

4. (*a*) A current of steam is passed through a red hot iron tube. Specify any chemical changes that seem likely to occur.
(*b*) A current of steam is passed into a mass of red hot coke. What are the chemical phenomena resulting?

5. A quantity of magnesium powder is ignited. What will happen if you pour water upon it, and why?

6. Are the terms inflammable and combustible synonymous? State any differences in signification that may occur to you.

7. How many volumes of hydrogen and oxygen respectively would be required to produce eight volumes of steam?

8. What are the main properties of water? From what does its value as a fire-extinguishing agent principally arise?

9. How may ammonia be obtained? What are its principal properties and uses?

10. What is nitric acid? How is it prepared on a commercial scale? State the action of strong nitric acid upon any two of the following: iron, cotton, sawdust, lead, copper.

FIRE BRANCH.

PART I, F.—ELEMENTARY ELECTRICITY.

(*One hour-and-a-half allowed for this Paper.*)

QUESTIONS.

1. How would you prove that (1) the potential is the same at every point on an electrified conductor? (2) the charge at any point on a conductor depends upon the shape of the conductor?

2. A gold leaf electroscope is placed upon an insulated metal stand. State and explain the indication of the leaves when the

stand receives a positive charge. How would the indication be modified if the leaves were earth connected?

3. When the terminals of an electrical machine are at a certain distance apart, sparks pass between them if the machine is worked. State and explain the effect of connecting one of the terminals by a wire with the interior of a Leyden jar, of which the exterior coating is uninsulated.

4. Describe experiments (1) to shew the extreme rapidity of electrical discharge, (2) to shew how it may be retarded.

5. What is meant by a voltaic cell; and whence is the energy of the electric current, which it generates, derived? Describe fully, with sketches, any form of voltaic cell with which you are acquainted.

6. Cells are described as being joined (1) in series and (2) in parallel. What is meant, and how would you join them to obtain the highest E.M.F.? Give your reasons.

7. Quote Ohm's law, and find the current that can be sent through a resistance of 8 ohms by an E.M.F. of 30 volts.

8. Describe the general construction of an incandescent electric lamp, and explain why a high temperature is produced only within the lamp.

9. Describe and explain how the magnetic effects of a coil of wire through which a current is passing are affected by introducing into the coil a rod of soft iron of the same length as the coil.

FIRE BRANCH.

PART II, SUBJECT A.—KNOWLEDGE OF TARIFFS (CLOTHING FACTORIES).

QUESTIONS.

1. Quote the Clauses at the commencement of the Tariff (*a*) defining the different classes of risks rateable under the general term "Clothing Factories," and (*b*) detailing the exceptions to the rule.

2. What floor openings are allowed without charge?

3. What are the provisions as to Average?

4. What is the "defective construction" charge?

5. State the additional tenancy extras for (*a*) "Storeyed Buildings," and (*b*) "Sheds."

6. How do the rules as to Agencies and Commission read? Quote them.

7. What are the two "Normal" rates?

8. Detail the item as to waterproof garment making, and rubber solution storage or use; and say what are the additional charges set out under this head?

9. If bisulphide of carbon is used or stored, what is the "Extra" payable?

10. Write out the Warranties which have to be inserted in policies when additional rates under items 8 and 9, above, become chargeable.

11. What are the regulations as to fire-proof buildings?

12. Write out the machinery item of the "Form of Specification."

FIRE BRANCH.

PART II, SUBJECT A.—KNOWLEDGE OF TARIFFS—COTTON MILLS (England and Ireland).

(*One hour-and-a-half allowed for this Paper.*)

QUESTIONS.

1. Give a list of buildings to which this tariff applies.

2. Under what circumstances is it permissible to allow communications without extra charge.

3. State the additional rates chargeable under Section 1, Class 2, of this tariff for the following:—

(*a*) Incandescent Gas Lights.
(*b*) Superheated Steam.
(*c*) Night Work.
(*d*) Electro-motors.

4. Rate a non-fireproof Mill, spinning 60's, five storeys high, 1st Weaving, 2nd Carding and Preparing, 3rd, 4th, and 5th, Ring Throstle Spinning on 40,000 spindles.

5. Rate a non-fireproof Mill, similar to last-mentioned, but containing 30,000 Mule Spindles instead of the Ring Spindles.

6. Give the rates for building and contents of a fireproof detached Building, two storeys high, used in connection with a non-fireproof Class I Mill, and occupied as follows:—1st Blowing room, 2nd Mixing room, containing two bale breakers delivering Cotton on to an overhead lattice into the room, and having also two iron traps to 1st storey.

7. Describe, briefly, (*a*) a Bale room, (*b*) a Bale-breaking room.

8. Describe the Construction necessary for a Fireproof Mill.

9. What are the Normal Rates, with and without average for Building and Contents of the first floor of a Fireproof Mill occupied for Carding and Preparing?

10. State the Normal Rates for the following non-sprinklered Risks :—

(*a*) A Power Loom Weaving Factory of two storeys and attic.

(*b*) A Doubling Mill of two storeys and attic containing more than 5,000 Doubling Spindles.

(*c*) Non-fireproof Factory partly used for flannelette finishing.

(*d*) Fireproof Factory partly used for flannelette finishing.

11. Write out fully the specification wording for Machinery and Stock. Under what circumstances are these items subject to Average.

12. Draw a diagram to illustrate arrangement of Blowing Room which renders a Class 2 Mill subject to additional rate of 3s. 6d. for processes previous to Carding.

13. Draw a diagram to illustrate arrangement of Blowing Room, which does not render the Mill subject to an additional charge for processes previous to Carding.

FIRE BRANCH.

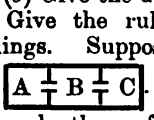
PART II, SUBJECT A.—KNOWLEDGE OF TARIFFS (BOOT AND SHOE).

(*One hour-and-a-half allowed for this Paper.*)

QUESTIONS.

1. (*a*) Give the definition of a Factory under the above tariff.

(*b*) Give the definition of a Warehouse under the above tariff.

2. Give the rule as regards adjoining and communicating buildings. Suppose a risk to be in accordance with a diagram thus 

. A, B, and C all communicate, and are rated independently as follows: A, storeyed factory at 11s. 6d.; B, warehouse, at 4s.; C, shed factory at 3s. 6d. What are the rates for each due to communication?

3. Give the rule as regards defective construction, and rate the following risk: A factory, 4 storeys in height, S. or B. built and S. with exception of one end, which is of corrugated iron for extension purposes, having ceilings of wood, internal stairs, gas engine in non-fireproof compartment, and 250 hands employed.

4. What is the charge for stixole or other fastening material not containing rubber, provided it is used cold, and what warranties should be excepted if it is so used? Also, what is the charge for making rubber solution on the premises? Again, if rubber solution is neither used nor made, is there any charge for the

storage of these ingredients, provided the amount is limited to a day's consumption.

5. Define the word "premises," and state if in computing the number of hands in a factory and warehouse communicating, the occupants of both buildings have to be aggregated.

6. State the warranties that must be applied in every insurance under this tariff.

7. Rate the following risk :—A factory of 4 floors, each of which is fireproof, and approached by stone staircase, the door to each room being of wood.

Ground floor (or 1st storey).—Having gas engine and wood linings.

1st floor (or 2nd storey).—Having wood linings, 2 stoves with more than 3 feet of pipe, and conditioning by gas heat.

2nd floor (or 3rd storey).—Rubber solution used in ordinary tins, and wood linings.

3rd floor (or 4th storey).—Roof (lantern).

Also what extra is payable in connection with the above risk, irrespective of processes?

Again, suppose there are 150 hands in the above building, but not more than 50 on each floor, is there any charge for same?

8. Suppose a factory and a warehouse adjoin and communicate, and in the latter building (warehouse) there is a non-fireproof compartment containing a gas engine (the said compartment communicating with factory by ordinary wood door), to which building does the extra for same apply under the tariff?

9. If a shed factory adjoins and communicates with a building of two storeys used for the manufacture of uppers, without power, in which less than 30 hands are employed, what would be the normal rate for such shed factory?

10. Given a factory of five storeys in height (no basement) in single tenure, and employing 500 hands, what is the highest rate for same, supposing all the extras are chargeable? Similarly, what would be the rate for a warehouse of like description? Please state each item, and the charge for same.

N.B.—The factories mentioned in the above questions are worked by power, except where otherwise stated.

FIRE BRANCH.

PART II, SUBJECT B.—PROCESSES OF MANUFACTURE (BOOTS AND SHOES).

(*One hour-and-a-half allowed for this Paper.*)

QUESTIONS.

1. Name the chief kinds of skins from which uppers are cut.

2. What do you understand by the following terms.
(*a*) Closing, (*b*) fixing and fitting, (*c*) skiving (or skiveing), (*d*) channelling, (*e*) rubbing down, (*f*) edge setting, (*g*) sole scouring.

3. Give a short description of a welted boot, and a machine-sewn boot.

4. Why are some boots and shoes dried in a drying room after manufacture, and not others? What is the purpose of this drying?

5. Of what materials is "fake" composed, and why is its manufacture, in a boot factory, dangerous?

6. State the solvent generally used in rubber solution, and why is an extra charge made for same?

7. For what purposes is rubber solution generally used in connection with the sole of a boot?

8. For what purpose is benzoline or naphtha generally used in a boot factory. (*A*) How, and in what quantity, shonld it be allowed to be kept?

9. Of what materials are "patterns" generally made, and why are they usually difficult to deal with in case of a loss?

10. Name the machines generally to be found in the following rooms (*a*) Press room, (*b*) Closing room, (*c*) Lasting room, (*d*) Finishing room.

11. Give a short description of the manufacture of canvas and rubber tennis shoes. Is rubber solution always used, and, if so, to what part of the shoes is it applied, and why?

PART II, SUBJECT B.—PROCESSES OF MANUFACTURE (COTTON).

(*One hour-and-a-half allowed for this Paper.*)

Questions.

1. Name the chief varieties of raw cotton, and their characteristics.

2. Name, in order, the processes through which cotton is passed in the course of conversion into yarn.

3. State the principal difference between the style of machines used for Mule and for Ring spinning, and why one is regarded more favourably in Fire Insurance practice than the other.

4. State which is more suitable for the longer stapled cottons, and why.

5. Place the following processes in proper sequence, and state the object of each, viz.: Drawing, Carding, Blowing, Roving.

6. Describe, as fully as possible, the method of treating cotton up to but not including the carding process.

7. In yarn doubling, what is meant by the term "gassing," and what is the object of the process? What precautions, if any, should be taken to prevent fire?

8. The term "Warehouse" is colloquially used to describe the main building (other than the weaving shed) at a cotton weaving factory. What is done besides warehousing in a building of this character?

PART II, SUBJECT C.—BUILDING CONSTRUCTION.

(One hour-and-a-half allowed for this Paper.)

QUESTIONS.

1. BOND IN BRICKWORK.
   (*a*) State the standard size of a brick.
   (*b*) What is meant by Brick Bond or breaking joint?
   (*c*) Illustrate your answer.
   (*d*) What is the object of breaking joint?
   (*e*) Sketch a piece of walling with no bond or breaking joint.
   (*f*) Describe the effect, in the latter case, that a heavy load would have on an unsound foundation.

2. STONE DRESSINGS.—Describe briefly:—Plinths, Sills, Heads, Jambs, Mullions, Strings, Cornice.

3. WOOD FLOORING.—Draw a rough sketch showing the construction of an ordinary single naked flooring of a dwelling, having a fire place. Sizes of timber not required, but the description of the timber must be stated.

Describe
   (*a*) Straight or plain jointed flooring.
   (*b*) Grooved and tongued.

Why is the latter preferable—from an Insurance point of view—when the floor is to carry machinery?

4. ROOFS.—When are Queen Post Roofs usually adopted.

Give a rough sectional sketch of a Queen Post Roof, and mark thereon the Queen Posts (Q.P.), straining beam (S.B.), straining sill (S.S.), tie-beam (T.), principal rafters (P.R.), struts (S.), and upright to support ridge (R.).

5. Two adjoining buildings—having a party wall—of six storeys, communicating by an ordinary doorway on each floor, are occupied by a draper, who is desirous to so alter the communications as to entitle each building to be rated as a separate risk, but stipulates he must have communication between the buildings on the basement and ground floors.

Sketch a section of the two buildings showing the communications on these two floors (it being assumed the openings on the

other floors are bricked up), and state the construction and protection necessary to meet the requirements of the Tariff.

6. With a view to minimise the risk of Fire, suggest:—
   (*a*) The construction of a basement chamber to contain the boiler for an extensive system of heating by hot water.
   (*b*) Protection necessary for a metal coal stove for warmth placed on an ordinary wood floor, having smoke pipe within three inches of a wood-lined wall, the pipe to be allowed to remain in that position.

PART II., SUBJECT E.—CORRESPONDENCE.

(*Two Hours allowed for this Paper.*)

QUESTIONS.

1. An agent writes, by late post on December 24th, that he has given protection for £10,000 "on a Sawmill" (no name specified); this he says he has done in the hope of securing the business, as he knows that the owner has had some difficulty with his offices. Reply.

2. An Insured desires that someone may be sent from the office to value his furniture, "so that there may be no quibble after a fire." He does not see how it could be possible to arrive at the value of his household effects after they have been destroyed. Reply.

3. Write to a rather careless agent a third, and urgent, application for separate sums, which are required to complete an outstanding proposal.

4. For a tariff risk you have quoted rates which you know to be correct, according to your recent survey. The agent writes that his friends inform him they "can do much better with an office quite as good as yours." Reply.

5. A risk has to be declined at renewal, but, owing to an oversight in your office, no intimation has been sent to the Insured. Write, three days before Quarter Day, to the Insured and to the Agent.

6. A Manufacturer wishes to know how the value of his machinery would be arrived at in the event of a fire, especially how the question of depreciation would be dealt with. He adds that the machinery is doing its work satisfactorily, and is well maintained, and that he should therefore expect to be paid as for the reinstatement of the same. Reply.

7. Draft a circular letter to a class of manufacturers to intimate that, in consequence of a new tariff, the policies falling renewable with the office at the ensuing Quarter Day will have to be revised.

(You have to prepare your Insured for an advance in rates, and for the imposition of Average.)

PART II., SUBJECT F.—PLAN DRAWING.

(*Two Hours allowed for this Subject.*)

INSTRUCTIONS.

Draw to a scale of 40 feet to 1 inch.

The measurements thus <.....45.....> denote feet.

All party walls pass through roofs, unless otherwise described.

Doorways are indicated by crosses thus———X———X———

No. 1. Communicates with No. 2 by double iron doors. At the point *x* there is a window in 1st storey within 10 feet of a window in 1st storey of No. 5. Unprotected windows overlook the roof of said No. 5.

No. 2. The partition wall between (*a*) and (*b*) is of timber.

No. 3. There is a fireproof passage from 1st storey to 1st storey of No. 1, having an iron door at each end.

No. 5. In this building there are three horizontal steam boilers, each 30 feet in length and 7 feet in diameter, the space between each boiler and between the walls and the outer boilers being 3 feet. The dotted line indicates the furnace end of the boilers. The building is open to the yard at the end marked *x*.

No. 6. Chimney.

No. 7. (*a*) and (*b*) are two fireproof compartments in 1st storey, communicating by single iron door; (*c*) is a fireproof passage in 1st storey, communicating with (*b*) and (*d*) by single iron doors. In (*d*) there is a brick-built hoist, 6 feet by 6 feet, the openings having metal-covered doors thereto, and the walls being carried up to but not through the roof.

No. 9. The second storey communicates with 2nd storey of No. 7 by an enclosed wood gangway, having a metal-covered door at No. 7 end. There is a timber-built hoist 5 feet by 5 feet through the floors.

No. 11. This building is one storey in height, the wall separating the compartments (*a*) and (*b*) being carried up to but not through the roof; (*b*) and (*c*) are separated by a timber partition.

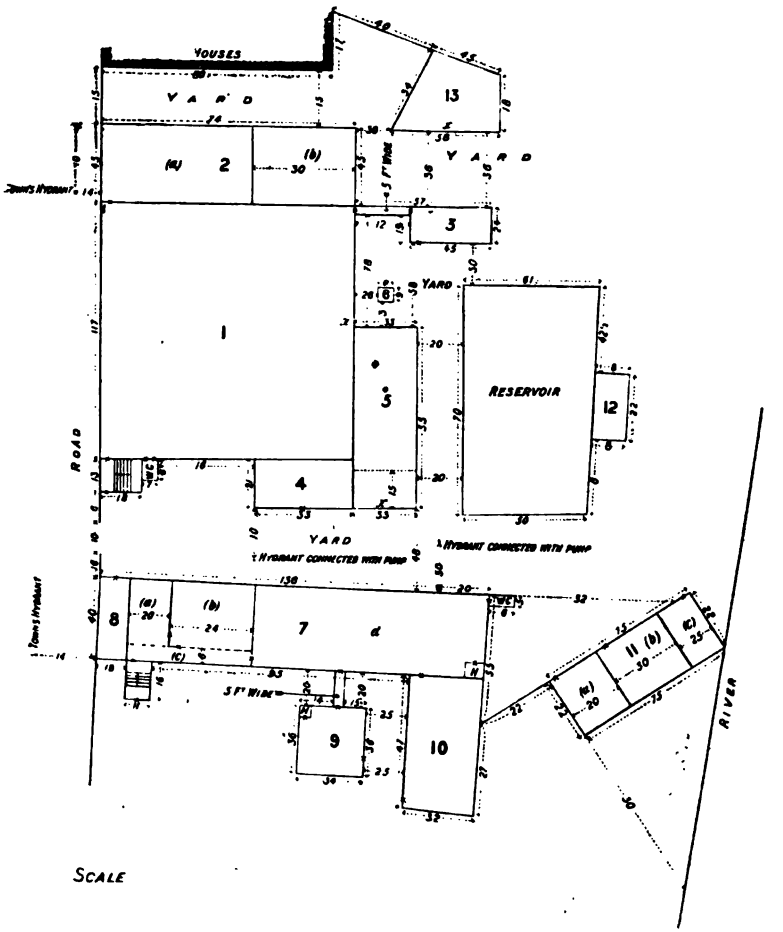
No. 12. Timber-built shed.

No. 13. The side marked *x* is open to the yard.

STANLEY MILLS, HIGHTOWN, LANCASHIRE.

Owner: GEORGE HARISON.

Occupiers: HENRY MORTON & SONS, Cotton Spinners.



ACCIDENT BRANCH.

PART I.—SUBJECT: KNOWLEDGE OF EMPLOYERS' LIABILITY. Acts 1880, 1897–1900.

(*One hour-and-a-half allowed for this Paper.*)

QUESTIONS.

1. To what employments does the Workmen's Compensation Act, 1897, apply?
2. Who are benefited by the extension of the Workmen's Compensation Act, 1900?
3. What is the scale of compensation laid down by the Workmen's Compensation Act
   (*a*) For Fatal accidents, with dependents, either total or partial?
   (*b*) For Non-fatal accidents?
4. Who are dependents under the Workmen's Compensation Act?
5. What questions would you ask an employer engaged in building operations, whose workman had met with accident by the giving way of a scaffold?
6. The occupiers of a factory send a carman to Railway Station to collect goods. Whilst there, he is injured by the carelessness of a servant of the Railway Company. What are the respective positions and rights of
   (*a*) The Workmen?
   (*b*) His employers?
   (*c*) The Railway Company?
7. As the result of want of proper guarding of a driving belt, an employee is severely injured. Under what Act should the claim be lodged, and why?
8. Explain the difference in the liability of an employer to his workpeople in respect of accidents.
   (*a*) Under the Employers' Liability Act, 1880.
   (*b*) Under the Workmen's Compensation Act, 1897.

PART 1.—SUBJECT: CLASSIFICATION OF RISKS. (PERSONAL ACCIDENTS.)

(*Three-quarters of an hour allowed for this Paper.*)

QUESTIONS.

1. Give six trades or professions in each of the three classes:—
   (*a*) "Ordinary." (*b*) "Medium." (*c*) "Hazardous."

2. Indicate the correct classification:—
   1. Master Builder (occasionally working).
   2. Vet. Surgeon.
   3. Butcher (not working in slaughter-house).
   4. Mining Engineer.
   5. Steeple Jack.
   6. Clerk of Works.

3. Name six occupations which are not insurable under Personal Accident Insurance Policy.

PART I.—SUBJECT: CORRESPONDENCE.

(*One hour-and-a-half allowed for this Paper.*)

QUESTIONS.

1. Write a letter to an applicant for an Agency, who asks for exceptional terms of commission, and who states that special terms have been offered him by several other Companies.

2. Write a letter declining to grant an Agency to an applicant who has an extensive connection and considerable influence, but whose repute as to the class of business he brings to the Company he represents is bad.

3. A risk under the Workmen's Compensation Act, having proved unprofitable for the past two or three years, an increased rating is to be suggested. Write the necessary letter to the Assured.

4. An Assured has an accident resulting in a permanent weakness of the knee joint. Write the necessary letter instructing the agent what to do. (Personal Accident.)

5. A valuable Agent, of good financial position, is irregular in his remittances. Write, drawing his attention to overdue account, and ask for settlement.

6. Your own and another Company are both being claimed upon by a Policy Holder who has met with an accident, the case being genuine. The other Company, having been already in communication with you, agrees to leave the settlement in your hands, but writes asking to be supplied with a copy of your Company's medical officer's special report upon the case. Reply to that letter.

PART I.—SUBJECT: BOOK-KEEPING.

(*Two Hours-and-a-quarter allowed for this Paper.*)

QUESTIONS.

1. Give the ruling of the heading of an Agency Account Ledger, for all classes of business usually transacted by an Accident Insurance Company.

2. Draft a Policy Register for Personal Accident Policies, and make an imaginary entry in same.

3. Draft the ruling of a Proposal or Order Book for Employers' Liability and Workmen's Compensation Proposals.

4. A Builder and Contractor holding the following composite policy in 1900 (direct insurance):—

Building,	estimated	amount	wages	£3,500 at 10/- per cent.
Contracting,	,,	,,	,,	£10,000 at 25/- per cent.
Brickmaking,	,,	,,	,,	£1,300 at 10/- per cent.
Quarry,	,,	,,	,,	£750 at 15/- per cent.
Clerical Staff,	,,	,,	,,	£500 at 4/- per cent.

agrees to renew (1901) for same amount wages as estimated before, at following rates:—

Building, 12/- per cent; Brickmaking, 10/6 per cent; Contracting, 20/- per cent; Quarry, 17/6 per cent; Clerical Staff same rate.

Returns wages actually paid during 1900 as follows:—

Building, £2,950; Contracting, £13,470; Brickmaking, £1,560; Quarry, £625; Clerical Staff, £500.

Work out the risk, showing net amount due to the Insurance Company.

5. The following items are outstanding in an Agent's Account:—

No. 27,234 (P.A.). £5 premium (new business), T/A., 10 per cent.
No. 19,371 (P.A.). £4 premium (renewal), Bonus, 8/-.
No. 40,345 (W.C.A.). £20 2s. 6d. premium, Excess, £2 7s. 9d.
No. 41,738 (W.C.A.). £7 8s 3d. premium, Rebate, 7/9.
No. 20,864 (Burg.). £1 premium.
No. 23,791 (3rd Pty.). £20 premium.

Make out a statement deducting the following commissions:— On Personal Accidents, 15 per cent. new and 10 per cent. renewal; Workmen's Compensation Act, 10 per cent. new and renewal; Burglary, 15 per cent.; Third Party, 15 per cent. Allow 2/6 for postages, and show net amount owing.

N.B.—Special attention must be given to the form in which this account is worked out.

PART 2.—SUBJECT: POLICY DRAFTING.

(*Three-quarters of an hour allowed for this Paper.*)

QUESTIONS.

ENDORSEMENTS.

1. Give the wording of the Hernia Clause in connection with a Personal Accident Policy.

2. An assured loses the sight of the left eye, and after recovery (as far as is possible) from the effects of the accident, desires to re-insure; what endorsement should be placed upon his Policy.

3. What are the conditions of an endorsement on a Workmen's Compensation Act Policy, giving joint benefits in addition to covering legal liability?

PART 2.—Subject: INDEMNITY (Third Party).

(*Two hours-and-a-half allowed for this Paper.*)

QUESTIONS.

CORRESPONDENCE.

1. You have received notice that an accident has occurred, resulting in damage to a horse and cart, through alleged negligence upon the part of the driver of a traction engine, the hazard in connection with which is insured with your Company. What steps should be taken to safeguard your company's interests by the official in whose hand the matter is placed for investigation?

2. You are asked to quote rate to insure Third Party Hazard in connection with a short private railway connected with works. What would you do in the direction of ascertaining the nature of the risk before submitting proposal for consideration to your Head Office?

CLAIMS.

3. In the event of a Third Party Claim being submitted, which has occurred under circumstances which leave no doubt as to your Policy Holder's liability, the injured person being a skilled mechanic and the injury a fractured lower right arm, upon what basis would you estimate the amount for which the claim should be disposed of?

SETTLEMENTS.

4. A's private carriage is standing against curb outside a shop, on proper side of roadway, about mid-day, a heavily laden lorry is passing it, and an electric car runs into rear of lorry, causing same to violently collide with A's carriage, doing serious damage. Has A any legal remedy, and if so, against whom?

(NOTE.—All three vehicles heading in same direction.)

LEGAL ASPECTS.

5. What element in connection with the occurrence of an accident to a passenger by a public vehicle is essential to the establishment of legal liability, upon the part of the owner, for injuries sustained?

PART II.—Subject: CLAIMS AND THEIR SETTLEMENT.

(*Two hours allowed for this Paper.*)

QUESTIONS.

PERSONAL ACCIDENT.

1. What is the definition of the word "Accident" as meant by all Accident Companies, and stated in their Policies?

2. Having received notice of a Fatal Accident to holder of a Personal Accident Policy, what are the first steps to be taken?

3. The holder of a Personal Accident Policy, who has never had any symptoms previously, as the result of an attack of vertigo falls and fractures his leg. (*a*) What is the legal position of the Company? (*b*) What steps would you take in regard to the matter?

4. An Agent writes to the Branch Office that one of his Assured has met with an accident. What would you do if the matter were placed in your hands to deal with?

EMPLOYERS' LIABILITY, 1880.

5. A solicitor having written intimating a claim under the Employers' Liability Act, 1880, and your investigations showing there is no liability apart from the Act of 1897, write him a suitable letter in reply.

6. On receiving notice of an accident under Employers' Liability Act, 1880, what are the first steps to be taken *so far as an Insurance Company is concerned* before dealing with the claim?

7. Having received a claim under the Employers' Liability Act, 1880, from a Policy-holder, in the case of an injury alleged to have been sustained by the employee as the result of insufficient guarding, what steps would you take *re* investigating the circumstances?

WORKMEN'S COMPENSATION ACT.

8. What defences are there under the Workmen's Compensation Act?

9. What enquiries would you make in regard to an accident at a quarry?

10. A workman, in receipt of an average weekly wage of £2 5s., meets with an accident on the 22nd April. He remains at work until the 27th, when he leaves and does not return until the 23rd May. To what compensation is he entitled under the Workmen's Compensation Act?

PART II.—Subject: MEDICAL AND SURGICAL TERMS.

(*One hour allowed for this Paper.*)

1. Define, in non-technical language:—
   Tetanus.
   Septicæmia.
   Ecchymosis.
   Synovitis.
   Hæmorrhage.
2. Name the bones in the leg, from ankle to hipjoint, and give their relative positions.
3. What is:—
   (*a*) Phlebitis?
   (*b*) Orchitis?
   (*c*) Meningitis?
4. Describe, in your own language:—
   (*a*) A fractured clavicle (left).
   (*b*) A ruptured ligament.
   (*c*) A sub-cranial hæmorrhage.
   (*d*) An aneurysm.

LIFE BRANCH.

PART I.—MATHEMATICS.

(*Three hours allowed for this Paper.*)

Candidates entering only for the subject of Compound Interest and Annuities-certain (Questions 13 to 17) will be allowed one hour only.

The following logarithms may be assumed:—

Log.	5·0	=0·69897	Log.	356·29	=2·55180
,,	23·0	=1·36173	,,	490·0	=2·69020
,,	150·0	=2·17609	,,	1967 75	=3·29397
,,	261·85	=2·41806	,,	2511·4	=3·39992

Questions.

1. What amount of Midland Railway $2\frac{1}{2}$°/₀ Debenture Stock at $85\frac{1}{8}$ can be purchased for £10,000, allowing for brokerage at 5s. 0d.°/₀ on the nominal amount of Stock bought, stamp duty at 5s. 0d. for each £50 paid to the transferor, a registration fee of 5s. 0d., and a contract stamp of 1s. 0d. What annual income per cent. will the transaction yield to the purchaser after allowing for Income Tax at 1s. 2d. in the £?

2. What would be the cost of covering with carpet, at 6s. 6d. per square yard, a hall of the shape of a regular hexagon, the length of whose side is 20 feet?

3. A cube contains 52,734,375 cubic inches. Find to 3 places of decimals the difference between the lengths of its side and its diagonal.

4. What is the value in francs of 133 dollars, 47 cents, assuming that a dollar is worth $49\frac{7}{32}$ pence, and that £1 is equal to 25·21 francs.

5. Simplify $\dfrac{6\cdot787}{2\cdot17\dot{4}\dot{2}} \times \dfrac{\cdot2\dot{5}\dot{9}}{2\cdot78}$ of 12s. $9\frac{3}{4}$d.

6. Find the value of

$$\text{Log.}\left\{ (2\cdot16)^{\frac{1}{4}} \times (1\cdot2)^{\frac{3}{2}} \div (270)^{-\frac{1}{2}} \right\}$$

7. Find the cube root of

$$64-96a+192a^2-152a^3+144a^4-54a^5+27a^6.$$

8. Deduce, by means of factors, the value of x in the following equations, viz.:—

(1) $2x^2-5ax-3a^2=0.$

(2) $(2a-5x)^2-1=0.$

9. Simplify

(1) $$\frac{1}{a-\dfrac{1}{a+\dfrac{1}{a}}} - \frac{1}{a+\dfrac{1}{a-\dfrac{1}{a}}}$$

(2) $$\frac{1}{x+\sqrt{x^2-1}} + \frac{1}{x-\sqrt{x^2-1}}$$

10. Find the value of

$$\left\{ (32)^{\frac{3}{5}} + (64)^{\frac{4}{3}} - \frac{1}{(25)^{-\frac{3}{2}}} + \frac{\sqrt[3]{3}}{(9)^{\frac{1}{3}}} + \frac{(100)^{\frac{1}{2}}}{(125)^{\frac{1}{3}}} \right\}^{\frac{1}{2}}$$

11. The sum of 5 numbers in Arithmetical progression is 10, and the sum of their squares is 270. Find them.

12. Find, by means of the formula for the sum of a series in Geometrical progression, the value of $1\cdot28\dot{3}4\dot{7}$.

13. Define (1) Nominal rate of interest.
(2) Effective rate of interest.
(3) Force of interest.
(4) Annuity-certain.
(5) Perpetuity.

14. Calculate in how many years a sum of money will treble itself at compound interest, at 5% per annum.

15. Deduce a formula for the present value of an annuity-certain 1 payable annually for t years at the effective rate of

interest i per annum; and give a verbal interpretation of the formula obtained.

16. A loan of £15,000 is repayable by equal half-yearly instalments of principal and interest combined, extending over a period of 15 years. Assuming interest to be at the rate of 7% per annum, what will be the amount of the half-yearly instalment?

17. Find the present value of £850 10s. 0d. at 5% per annum compound interest, due at the end of 25 years.

LIFE BRANCH.

PART II.

(*Three hours-and-a-half allowed for this Paper.*)

QUESTIONS.

1. What do you understand by the "Force of Mortality"? Wherein does this differ from the "Rate of Mortality"?

2. What Mortality Tables would you use for the following calculations? Give your reasons.

(1) Calculations of Office Premiums for Ordinary Whole Life and Endowment Assurances.
(2) Valuation of liabilities under Ordinary Assurance contracts.
(3) Purchase price of Annuities.
(4) Industrial Office Premiums—weekly payments.
(5) Valuation of Reversions.

3. An Industrial Premium is calculated on the assumption that 75 per cent. of the first year's gross premium, and 37½ per cent. of the renewals (gross), are required to meet expenses. Show the formula for weekly premiums in terms of P, where P^1 = gross premiums, and P = net premium.

4. Show the necessary headings for the calculation by the columnar method of a Table of Premiums, for which the following is the formula for the premiums:—

$$P^1 = \frac{P \times 4}{3 - \frac{1}{\bar{a}_{\overline{x-n}|}}}$$

5. What is the $H^M{}^{(5)}$ Table? For what purposes is it used, and why?

6. What do you understand by a "Select" Table of Mortality? Where do Sprague's Select Tables of Premiums (whole life assurance) differ from the H^M Tables? How do you account for this difference?

7. Calculate from the following data the net surrender value at the end of n years of a policy for £100 taken out at age x.

Net premium at age x	..	=	01880
" "	$x + n$	=	02589
A_{x+n}	.. .. ..	=	17·176

8. What practical considerations should be kept in view in quoting the Office Surrender Value of (1) a Children's Endowment, (2) of an Annuity, (3) of a Half-Premium Policy?

9. A life, aged 30, proposes to take out a policy for £1,000 payable at death. He wishes to pay at date of acceptance a sum of £100 in addition to an annual premium for life. Give a formula for calculating the annual premium in terms of the Office Annual and Single Premiums.

10. Draft a letter of reply to a policy holder who claims as Surrender Value the full premiums he has paid with interest.

11. Explain the difference between book-keeping by single and by double entry. What are the advantages of each system?

12. A claim of £1,500 is payable at a Branch Office under deductions of (1) loan of £500; (2) interest, £15, less income-tax, 17s. 6d. A cheque for £1,000 is remitted from the Head Office to the Branch Office to enable the latter to pay the claim. Draft the necessary entries in the Branch Office books.

NAMES OF SUCCESSFUL CANDIDATES—1902.

The following is the Official List of the Successful Candidates at the Examinations, held simultaneously at the various Insurance centres, April 22nd to 30th, 1902. The letter "P" opposite a name signifies Pass, and "H" Honours.

FIRE BRANCH.

	Part I.								Part II.								
	Policy Drafting.								Tariffs.			Processes of Manufacture.					
	Clothing Factories.	Boot and Shoe Factories.	Re-Insurances.	F. O. C. General Rules.	Book-Keeping.	Chemistry.	Electricity.	Passed in Part I.	Clothing Factories.	Boot and Shoe.	Cotton Mills.	Boot and Shoe.	Cotton.	Building Construction.	Correspondence.	Plan Drawing.	Passed in Part II.
Birmingham.																	
Heaton, A. W., *Law Union and Crown*	...	...	H	H	...	...	...	...	...	...	...	...	...	...	...	...	...
Jones, A. H., *Royal Exchange*	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Milnes, W. A., *National of Ireland*	P	P	...	H	...	...	...	...	...	...	...	...	...	...	...	...	...
Robinson, R. V., *Atlas*	...	...	P	P	...	P	P	...	...	...	...	...	...	...	...	...	...
Turner, H. E., *Scottish Union and National*	...	H	H	H	P	...	...	1902	...	P	...	...	...	P	P	P	...

NAMES OF SUCCESSFUL CANDIDATES, 1902—*continued.*

	Part I.								Part II.								
	Policy Drafting.								Tariffs.			Processes of Manufacture.					
	Clothing Factories.	Boot and Shoe Factories.	Re-Insurances.	F. O. C. General Rules.	Book-Keeping.	Chemistry.	Electricity.	Passed in Part I.	Clothing Factories.	Boot and Shoe.	Cotton Mills.	Boot and Shoe.	Cotton.	Building Construction.	Correspondence.	Plan Drawing.	Passed in Part II.
Bristol.																	
Gillingham, S. J., *Northern*	...	...	...	P	...	...	P	...	...	...	...	...	...	...	...	...	...
Kepple, R. H. J., *Norwich Union*	...	...	H	H	P	...	...	...	...	...	...	...	...	...	...	...	...
King, W. Stacey, *Law Union and Crown*	...	...	...	P	H	...	...	...	...	...	...	...	...	...	...	...	...
Poole, W. H., *Northern*	...	...	...	P	P	...	P	...	...	...	...	...	...	...	...	...	...
Dublin.																	
Butler, S. P., *Royal*	...	...	...	...	H	...	...	...	...	...	...	...	...	P	P	P	...
Carry, E., *Guardian*	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Gordon, G., *Guardian*	...	P	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Edinburgh.																	
Lamont, J. Jameson, *London and Lancashire, F.*	...	H	H	H	H	...	H	...	...	...	...	...		...	...	...	...

GLASGOW.																					
Cunningham, J., *Union*		P	P	P																	
Gall, A. Martin, *West of Scotland*			H	P																	
Laidlaw, J. Hunter, *North British and Mercantile*			H	P		H															
Lillie, D. S. Allan, *West of Scotland*			P																		
Mackinnon, J. H., *West of Scotland*			H	H																	
Oliphant, J., *West of Scotland*		P		P	P																
Prosser, Colin R., *West of Scotland*				H	H																
Shumacker, Hy., *West of Scotland*				P																	
LEEDS.																					
Banks, H., *North British and Mercantile*				P																P	
Bastow, J. A., *Atlas*		P	H																		
Bennett, J. E., *Law Union and Crown*										P											
Coates, A. O., *Yorkshire*																				P	
Cooke, H., *Liverpool and London and Globe*											1902	P									1902
Eckford, J. P., *Royal Exchange,*											1902										
Foster, J. W. W., *Liverpool and London and Globe*										P		P							H	P	
Goulding, J. H., *Westminster*			H	H		P															
Gray, H., *Westminster*			P	P																	
Leishman, J., *North British and Mercantile*	P	H	H																		

NAMES OF SUCCESSFUL CANDIDATES, 1902—*continued.*

	Part I.									Part II.								
	Policy Drafting.									Tariffs.			Processes of Manufacture.					
	Clothing Factories.	Boot and Shoe Factories.	Re-Insurances.	F. O. C. General Rules.	Book-Keeping.	Chemistry.	Electricity.	Passed in Part I.	Clothing Factories.	Boot and Shoe.	Cotton Mills.	Boot and Shoe.	Cotton.	Building Construction.	Correspondence.	Plan Drawing.	Passed in Part II.
LEEDS—*continued.*																	
Metcalf, T. C., *Atlas*	...	...	...	H	P	H	...	1902	...	...	...	...	...	...	...	...	...
Metcalf, W. E., *North British and Mercantile*	...	...	H	H	...	P	...	...	...	...	...	...	...	...	...	...	...
Monkman, P. L., *Yorkshire*, York	...	...	...	H	P	...	...	...	...	...	...	...	...	...	...	...	...
Needham, E. J., *British Law*	P	P	H	P	...	...	...	...	...	...	...	...	...	...	...	...	...
Oates, F. E., *Westminster*	...	...	...	H	P	...	...	1902	...	...	...	...	...	...	...	...	1902
Simon, H. E. D., *Commercial Union*	...	P	H	H	P	...	...	...	...	...	...	...	...	...	...	...	...
Townend, J., *Liverpool and London and Globe*	...	P	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...
Wood, E. S., *Atlas*	...	P	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...
Wood, H. H., *Yorkshire*, York	...	...	...	H	...	...	...	...	...	...	...	...	...	...	...	...	...
LEICESTER.																	
Brister, C. S., *Hand-in-Hand*	...	...	H	P	...	...	P	...	...	...	...	...	...	...	...	...	...
Sharp W. H., *Hand-in-Hand*	...	...	H	H	...	...	H	...	...	...	...	...	...	...	...	...	...

Smith, R. S., *Royal*	...	P	P	P	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...
Wilson, A. E., *Hand-in-Hand*	P	...	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Wormleighton, E. A., *Hand-in-Hand*	...	P	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
LONDON.																			
Clayton, A. E., *Law Union and Crown*	...	...	...	P	P	...	...	...	P	...	...	...	...	...	...	...	...	...	...
Davies, W. J., *Royal*	...	...	H	P	P	...	P	...	...	...	...	...	...	...	...	...	...	...	...
Dubock, H. B., *Northern*	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Gerrard, J. G., *Royal*	...	...	...	...	...	...	...	1902	...	...	...	...	...	H	...	...	1902		
Green, W. E. *Sun*	...	...	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Manton, E. G., *Law Union and Crown*	P	H	H	H	P	P	P	1902	...	...	...	...	...	...	...	...	...	...	...
Walker, W. H., *Union*	H	H	H	H	P	H	H	1902	...	...	...	...	...	...	...	...	...	...	...
Whitehouse, E., *Northern*	P	H	H	H	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...
MANCHESTER.																			
Gray, W., *Royal*	...	P	H	P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Yorston, C., *British Law*	...	...	H	...	...	P	P	...	...	...	...	...	...	...	...	...	...	...	...
NEWCASTLE.																			
Armstrong, R. P., *Royal Exchange*	P	...	H	P	P	P	P	1902	...	...	...	...	...	...	...	...	...	...	...
Brown, H. A., *Liverpool and London and Globe*	...	...	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Dykes, E. C., *Union*	...	...	...	P	P	P	...	...	...	...	...	...	...	...	...	...	...	...	...

NAMES OF SUCCESSFUL CANDIDATES, 1902—*continued.*

	Part I.								Part II.								
	Policy Drafting.								Tariffs.			Processes of Manufacture.					
	Clothing Factories.	Boot and Shoe Factories.	Re-Insurances.	F. O. C. General Rules.	Book-Keeping.	Chemistry.	Electricity.	Passed in Part I.	Clothing Factories.	Boot and Shoe.	Cotton Mills.	Boot and Shoe.	Cotton.	Building Construction.	Correspondence.	Plan Drawing.	Passed in Part II.
NEWCASTLE—*continued.*																	
Hansen, G. E., *Norwich Union*	P	P	H	H	...	...	...		...	...	...	...	...	...	...	...	...
Hopper, W. J., *Royal*	...	...	H	H	...	P	...	...	...	...	...	...	...	...	...	...	...
Jobling, J. G. R., *Royal Exchange*	...	...	H	H	P	P	P	...	...	...	...	...	...	...	...	...	...
Judge, J. J., *Norwich Union*	...	...	P	P	...	P	...	...	...	...	...	...	...	...	...	...	...
M'Donald A. G., *Royal*	...	...	...	P	...	P	...	...	...	...	...	...	...	...	...	...	...
Thompson, H. E. G., *Norwich Union*	...	P	P	...	P	P	...	...	...	...	...	...	...	...	...	...	...
Unsworth, A., *Alliance*	...	P	H	P	...	...	...	...	...	...	...	...	...	...	...	...	...
Lloyd, T. P., *Northern*	P	H	...	H	...	...	...	...	...	...	...	...	...	...	...	...	...
Macmillan, J. A., *Northern*	P	P	H	H	P	P	P	1902	...	...	...	...	...	...	...	...	...
NORWICH.																	
Goddard, S. W. *Norwich Union*	...	...	P	H	...	...	...	...	...	...	...	...	...	...	...	...	...
Howard, S. A., *Norwich Union*	...	...	H	H	...	...	H	...	...	...	...	...	...	...	...	...	...

Page, C. F., *Norwich Union* ...	...	...	...	...	...	...	H	H	...	...	...	...	...	...	...	...	...	...	...	...	...
Self, E., *Norwich Union* ...	...	...	...	...	...	P	P	P	...	...	...	...	...	...	...	...	...	...	...	...	...
Walton, W. C., *Norwich Union* ...	...	...	...	...	P	...	...	H	...	...	...	...	...	...	...	...	...	...	...	...	...
PERTH.																					
Brown, Jun., R., *General Accident* ...	...	...	...	...	...	...	...	...	...	P	P	1902	...	...	...	...	...	...	...	P	...

LIFE BRANCH.

	PART I.				PART II.				
	Arithmetic, including use of Logarithmic Tables.	Algebra.	Theory of Compound Interest and Annuities Certain.	Passed in Part I.	Mortality Tables, Annuity Rates, and Office Premiums.	Characteristics of Principal Mortality Tables.	Surrender Values, Paid-Up Policies, &c.	Life Assurance Book-Keeping.	Passed in Part II.
LONDON.									
Blizard, G. P., *Scottish Equitable*	...	...	...	...	...	...	...	H	1902

NAMES OF SUCCESSFUL CANDIDATES, 1902—*continued.*

ACCIDENT BRANCH.

	Part I.					Part II.				
	Correspondence.	Book-Keeping.	Classification.	Employers' Liability.	Passed in Part I.	Claims.	Policy Drafting.	Indemnity Insurance	Medical and Surgical Terms.	Passed in Part II.
Bristol.										
Iles, J. J., *Royal Exchange*	...	P	P	...	...	...	...	...	...	...
Leeds.										
Coltman, A., *Employers' Liability*	...	P	H	P	...	...	...	...	...	...
Hagyard, C., *Ocean*	...	...	H	...	...	...	...	...	...	...
Plant, J. E., *Ocean*	...	...	P	...	..	..	...	...	...	...
London.										
May, H. J., *London Guarantee and Accident*	P	P	P	P	1902	...	...	...	...	...
Swanson, J., *London Guarantee and Accident*	P	P	H	P	1902	...	...	...	...	..
Newcastle.										
Fletcher, T., *Ocean*	P	H	H	H	1902	...	...	...	...	...
Stobbs, J., *Scottish Employers*	P	.	P	P	...	...	..	...	.	..

Mayor, G. *Commercial Union* ...	...	...	..	.	...	P	...	...	...	...	...	...
Scott, G. E., *Ocean*	...	..	...	...	...	P	...	...	...	...	...	...
NOTTINGHAM.												
Hill, F. N., *Norwich and London* ...	...	...	...	...	...	...	...	...	H	...	H	P	...

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